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NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT

DRAFT

DECEMBER 1993

RI WORK PLAN
VOLUME II OF III
QUALITY ASSURANCE PROJECT PLAN

CORRY STATION
PENSACOLA, FLORIDA

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA
29411-0068

DRAFT

QUALITY ASSURANCE PROJECT PLAN FOR SOIL AND/OR GROUND WATER CONTAMINATION REMEDIAL INVESTIGATION

NTTC CORRY STATION PENSACOLA, FLORIDA

Contract No. N62467-93-C-0680

Prepared by:

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David Driggers, Engineer-in-Charge

December 1993

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LIST OF ACRONYMS

AASHTO	American Association State Highway & Transportation Officials
ASTM	American Society of Testing & Materials
BLS	Below Land Surface
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Contract Laboratory Program
CompQAP	Comprehensive Quality Assurance Plan
CWA	Clean Water Act
DDT	Dichlor-diphenyl-trichloroethane
DOD	Department of Defense
DQO	Data Quality Objectives
DXF	Drawing Exchange Format
EC	Environmental Coordinator
ECUA	Escambia County Utilities Authority
EIC	Engineer-In-Charge
EQB	Equipment Blanks
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FS	Feasibility Study
FGS	Florida Geological Survey
g/L	Grams Per Liter
GAC	Granular Activated Carbon
GIS	Geographic Information System
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrophotometer
HSP	Health and Safety Plan
I.D.	Inside Diameter
IR	Installation Restoration
LPZ	Low Permeability Zone
LSD	Land Surface Datum
MCL	Maximum Contaminant Level
MDL	Minimum Detection Limit
µg/kg	Micrograms per Kilogram
mg/kg	Milligrams per Kilogram
µg/L	Micrograms per Liter
mg/L	Milligrams per Liter
MPZ	Main Producing Zone
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NGVD	National Geodetic Vertical Datum

LIST OF ACRONYMS (continued)

NTTC	Naval Technical Training Center
NWFWMD	Northwest Florida Water Management District
OLF	Outlying Landing Field
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Health and Safety Administration
OVA	Organic Vapor Analyzer
P.G.	Professional Geologist
PCB	Polychlorobiphenyl
PCE	Perchloroethylene or Tetrachloroethylene
PPB	Parts Per Billion
PQL	Practical Quantitation Limit
PVC	Polyvinyl Chloride
PWC	Public Works Center
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFP	Request for Proposal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROICC	Resident Officer in Charge of Construction
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SOUTHDIV	Southern Division
SSHAP	Site-specific Health and Safety Plan
SSQP	Site-Specific Quality Assurance Project Plan
STORET	STORage RETrieval
SZ	Surficial Zone
TBD	To be Determined
TCE	Trichloroethylene
T.D.	Total Depth
TMR	Telescoping Mesh Refinement
TOC	Top of Casing
USEPA	United States Environmental Protection Agency
USN	United States Navy
UST	Underground Storage Tank
UTM	Universal Transverse Mercator
VISA	Very Intensive Study Area
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This Quality Assurance Project Plan (**QAPP**) has been prepared by the Northwest Florida Water Management District (NWFWMD) for the Southern Division, Naval Facilities Command, under contract N62467-93-C-0680. That contract retains the NWFWMD to develop a plan for conducting an investigation of soils and ground water at the Naval Technical Training Center, Corry Station, Pensacola, Florida to determine the extent and source of dieldrin contamination.

1.1 Purpose

The purpose of this **QAPP** is to define responsibilities and prescribe requirements and procedures for assuring that the specific site investigations undertaken are planned and executed in a manner consistent with quality assurance objectives. This **QAPP** provides guidance and specifications to assure that:

- All field activities, including sample collection and physical measurements, are valid through conformance to accepted procedures, calibration, and preventative maintenance;
- Samples are identified and controlled through sample tracking systems and chain-of-custody procedures;
- Records are retained as documentary evidence of the quality of samples, applied processes, equipment, and results;
- Generated data are validated and their use in calculations is documented; and
- Calculations and evaluations are accurate, appropriate and consistent throughout the project.

1.2 Scope

The requirements and specifications of this **QAPP** apply to all NWFWMD and subcontractor activities as appropriate for each project undertaken under contract N62467-93-C-0680. The requirements and specifications of this **QAPP** will cover all activities associated with the collection and documentation of field analytical data and environmental samples for laboratory analysis up to, and including, delivery of samples to the analytical laboratory. A separate laboratory Quality Assurance Project Plan will be required of the analytical laboratory performing these services. The prime responsibilities delineated in **Section 4.0 -- Project Management Plan** extend to all quality-related controls and activities.

1.3 Quality Assurance and Quality Control Procedures

This **QAPP** defines the data and measurement quality objectives and details the methods, materials and procedures which will be used to assure that all technical data generated during the performance of the investigations at Corry Station are accurate, representative, and ultimately capable of withstanding professional scrutiny. Specific quality assurance/quality control (QA/QC) procedures to be employed, the responsibilities of NWFWMD personnel involved, and the administrative mechanism for coordinating the project are described in this document.

All QA/QC procedures will be in accordance with applicable technical standards, U.S. Environmental Protection Agency (USEPA) requirements, Naval Energy and Environmental Support Activity (NEESA) requirements, and specific project goals and requirements. This **QAPP** has been prepared in accordance with applicable USEPA, Florida Department of Environmental Protection (FDEP), and U.S. Navy guidance documents.

QC will consist of a system of checks on field sampling and laboratory analysis which will provide information on the quality of the methods used and of the analytical data. The NWFWMD will assure these objectives through appropriate precautions, careful scrutiny of method and procedure and systematic quality control checks.

QA procedures will provide the supervision and oversight necessary to certify that field and laboratory QC procedures have been properly implemented. The authority of NWFWMD personnel will extend to all the quality-related activities of these projects. The organization of the overall program, its lines of communication, designated responsibilities, and its quality assurance procedures are intended to work in concert to prevent sub-standard performance or erroneous results.

1.4 Oversight

The QA and QC procedures described in this **QAPP** are aimed at preventing isolated sub-standard or erroneous actions from occurring in essential areas. Subcontractors will be required to use laboratories with FDEP-approved Comprehensive Quality Assurance Plans (CompQAPs). Duplicate, blank, replicate and spiked samples will be used to develop estimates of the quality of the analytical data.

Detection limits will be in accordance with USEPA-approved methods, where available, for analysis of organics and inorganics.

Field audits will be conducted to verify that proper sampling techniques and chain-of-custody procedures are followed. Field data compilation, tabulation, and analysis will be checked for accuracy. Calculations and other post-sampling tasks will be reviewed by NWFWMD personnel.

Equipment used to take field measurements will be maintained and calibrated in accordance with established procedures. Records of calibration and maintenance will be kept by assigned personnel.

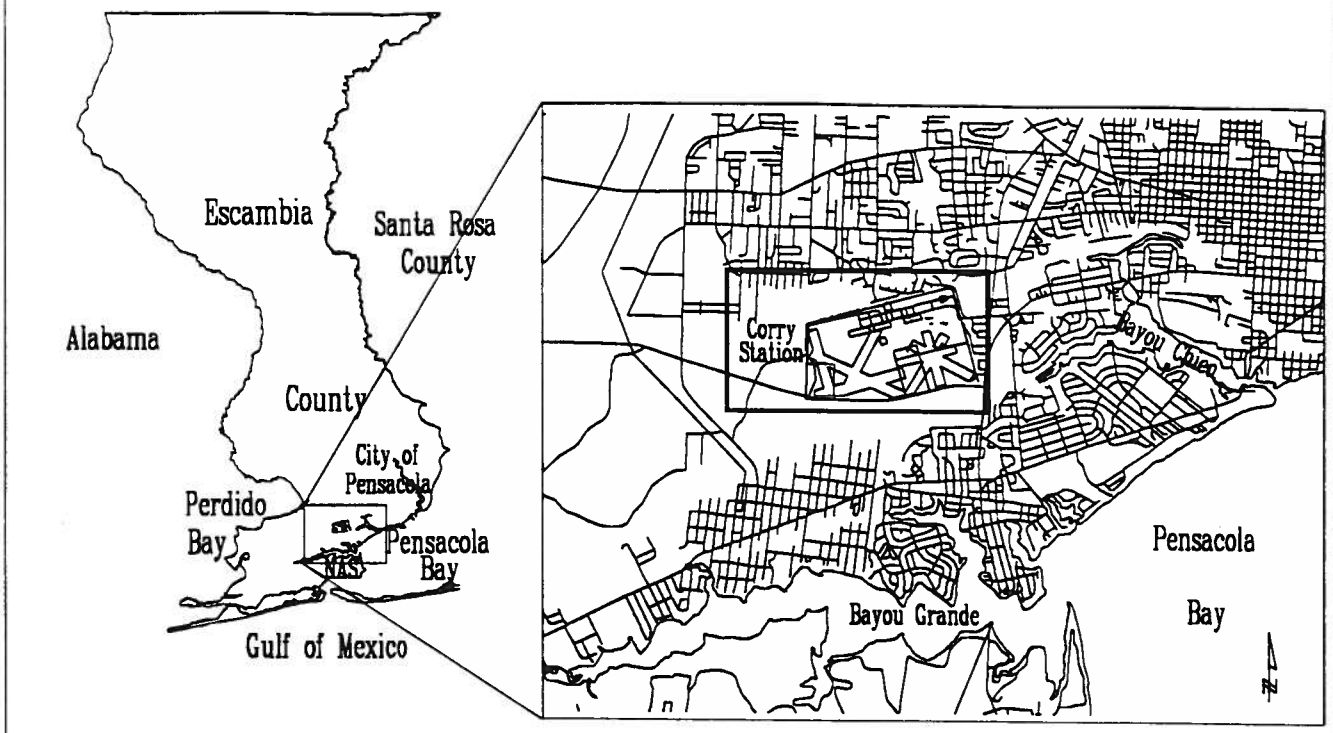
Document control procedures will be used to coordinate the distribution, coding, storage, retrieval, and review of all data collected during all fieldwork activities.

2.0 PROJECT DESCRIPTION

2.1 Facility Description

The NTTC Corry Station is located in southwestern Escambia County, Florida, approximately 1.5 miles (mi) west of the City of Pensacola and approximately 2.5 mi north of NAS Pensacola (Figure 2-1). The station has an area of 604 ac (ac) (NEESA, 1992) and presently hosts 4 principal functions: a Naval Technical Training Center (NTTC); the Naval Hospital; the Navy Shopping Mall; and Corry Family Housing. The NTTC is the station's primary mission and provides Navy personnel with training in cryptology, electronic warfare, photography, and optical and instrument repair (SOUTHDIV, 1989). This activity encompasses most of the station's surface area (431.5 ac). The Naval Hospital occupies 42.5 ac; Corry Family Housing occupies 88.5 ac; and the Navy Shopping Mall occupies 41.7 ac.

Historically, Corry Station has hosted a number of functions. The station was originally commissioned as an Outlying Landing Field (OLF) in 1928 (SOUTHDIV, 1989). It had this function for a period of 30 years, until 1958, at which time the OLF was decommissioned. In 1961, the station was recommissioned as a training center. In 1973, the station was re-designated a NTTC, with the addition of electronic warfare training and the Naval School for Photography (SOUTHDIV, 1989).



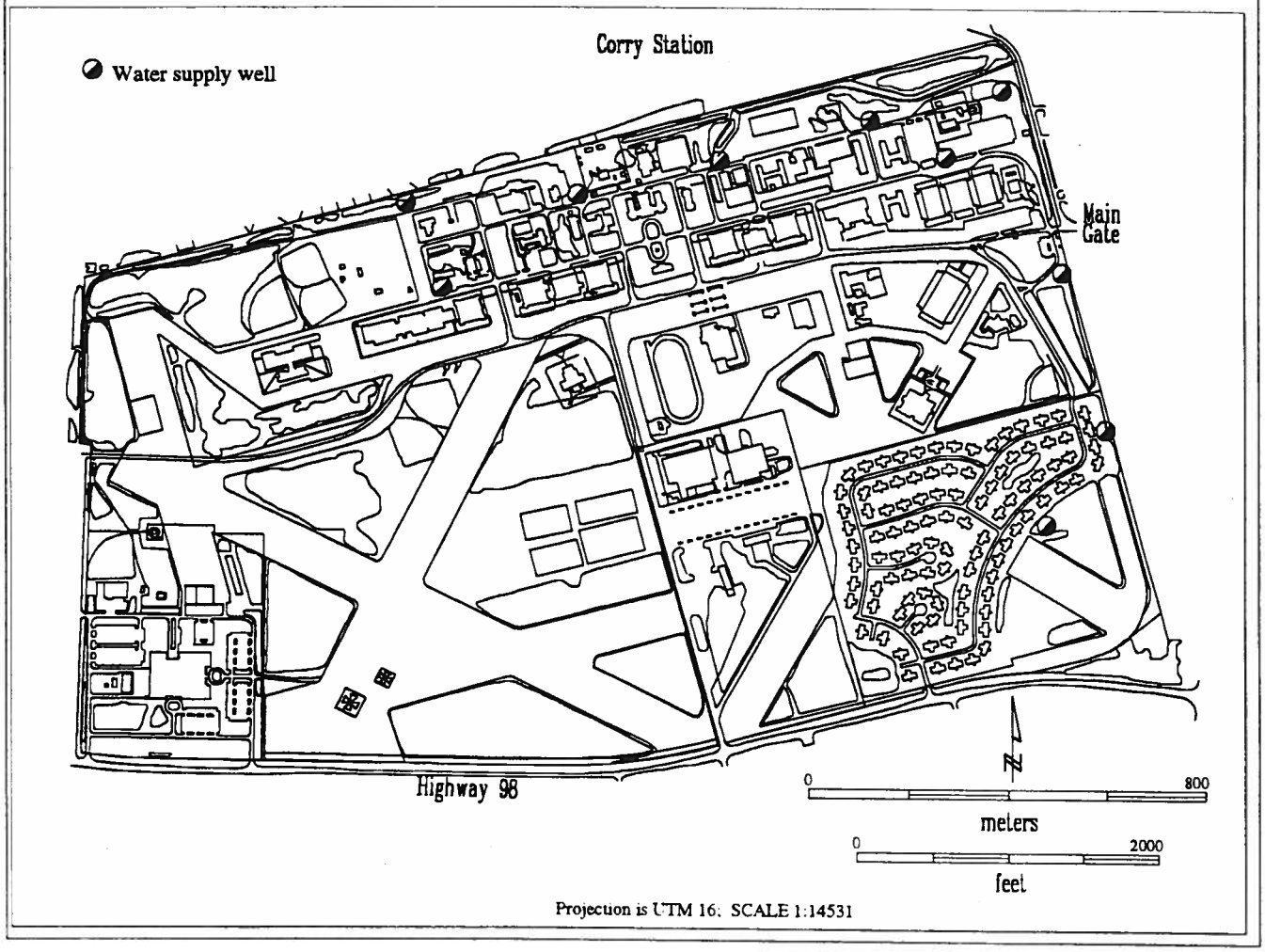


Figure 2-1. Corry Station in Southwestern Escambia County, Florida

2.2 Previous Investigations at Corry Station

Previous investigations into the nature and extent of ground water contamination at Corry Station are few in number. The most significant investigation to date was a potable water investigation conducted by the Oak Ridge National Laboratory (ORNL, 1989). This effort had several objectives, including confirmation of the presence of dieldrin in raw water from potable wells on Corry Station. A risk assessment was performed, as were mixing simulations. The goal of the mixing simulations was to assess the feasibility of reducing dieldrin concentrations to acceptable levels by judicious use of the existing wells. The ORNL work effort confirmed the presence of dieldrin at Corry Station.

E. C. Jordan Co. (1990) prepared a brief report on the status of the UST release detection program at Corry Station. The report cites regulated underground storage tanks (USTs) at three locations on Corry Station. These include: 3 tanks at the old base exchange service station; 1 tank at facility 1064; and 2 tanks at facility 3765 (Vehicle Fuel Dispensing Facility). The report documents construction details and boring logs for 4 compliance monitoring wells (CRY-1064-1 through CRY-1064-4) installed around facility 1064.

The Naval Energy and Environmental Support Activity (NEESA) prepared a Preliminary Assessment Report (NEESA, 1992) for Corry Station. This report documents a Potential Hazardous Waste Site Preliminary Assessment conducted for Corry Station. The report discusses: previous and current underground storage tanks; a suspected landfill; and the dieldrin contamination problem.

The NWFWMD will conduct a Remedial Investigation on the soils and ground water at Corry Station to determine the areal extent, the concentrations, and possible source(s) of the pesticide dieldrin, which has been detected and is being treated in all ten potable supply wells at Corry Station, which supply both Corry Station and NAS Pensacola. Other contaminants may be discovered and will be addressed as required by USEPA, State, and Navy policies.

2.3 Site-Specific Assessments

The activities to be undertaken by the NWFWMD will be technical investigations consisting of a variety of tasks at a variety of sites. Work activities to be undertaken at each site are described in the accompanying Work Plan document. Work to be undertaken at each site is presented in the form of a site assessment (Figure 2-2). The field activities which constitute a site assessment will be those measurements and samplings (soil, water, etc.) determined to be appropriate for each site. The site-specific assessments generated for the Corry Station investigation include the following information:

- Summary of proposed monitor well construction details;
- Site vicinity map with proposed sampling locations;
- Identification of investigation approach and methods;
- Summary of sample types, number, and analytical parameters.

There are seven site-specific assessments anticipated. The approach of the investigation is such that the site-specific assessments are independent from each other, in the effort to gain a synoptic understanding to the dieldrin problem. Therefore, each assessment is essentially, an investigation in itself. However, within each assessment there is a similar order of work tasks. The primary work task within each site-specific assessment targets the best perceived means to answer the particular issue of the assessment. In the event there is a basis for additional activities within the site-specific assessment, those activities are identified and will require workplan modifications. The site-specific assessments are outlined in Table 2-1.

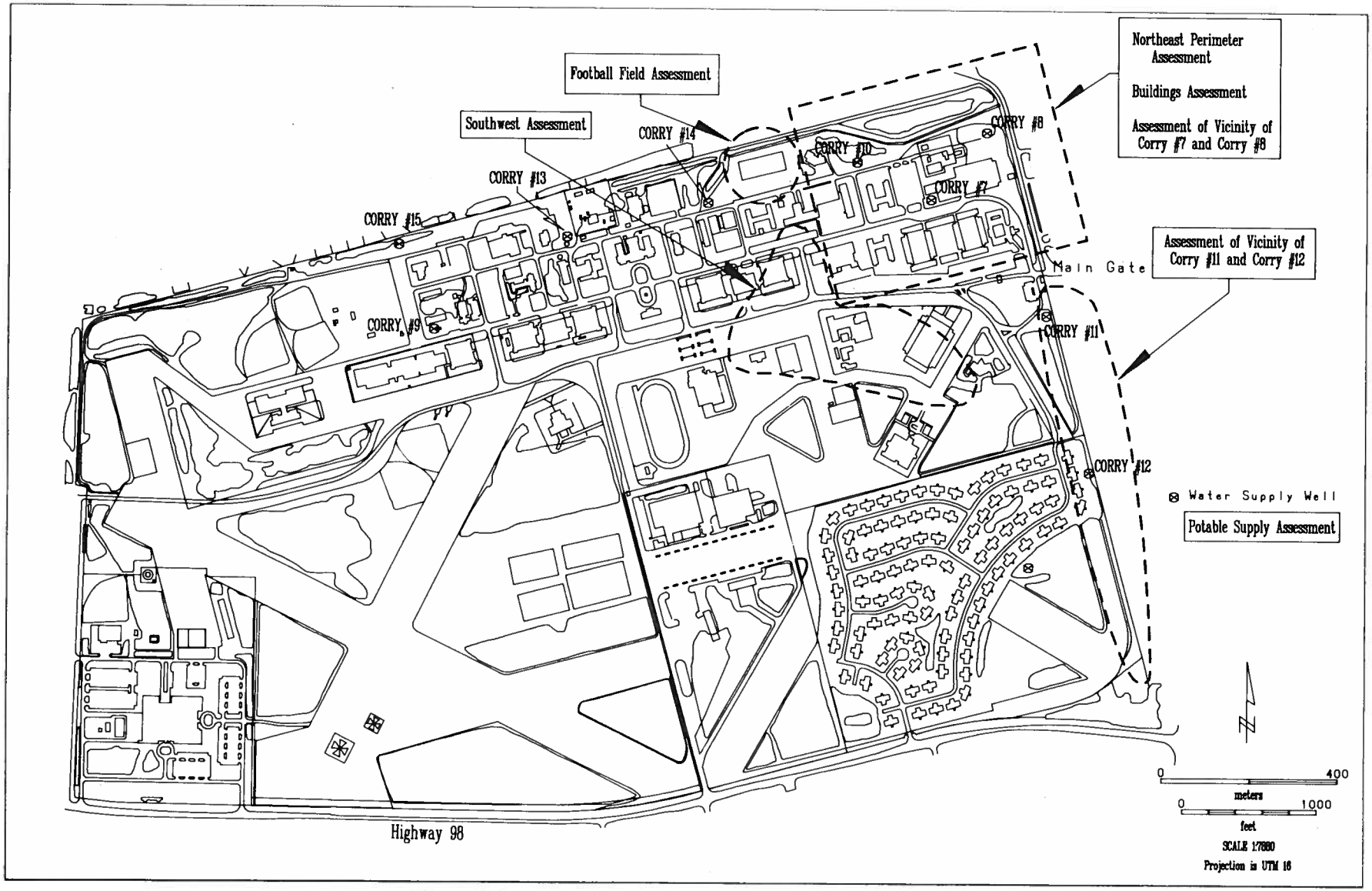


Figure 2-2. Targeted Areas for the Site-Specific Assessments.

TABLE 2-1

SITE-SPECIFIC ASSESSMENTS

Site #	Assessment	Purpose
1	Northeast Perimeter Assessment	Dieldrin distribution, Source characterization
2	Buildings Assessment	Source characterization
3	Football Field Assessment	Dieldrin distribution, Source characterization
4	Assessment of the Vicinity of Corry Wells # 7 and # 8	Dieldrin distribution, Source characterization
5	Southwest Assessment	Dieldrin distribution, Source characterization
6	Assessment of the Vicinity of Corry Wells # 11 and # 12	Dieldrin, benzene and PCE distribution, Source characterization
7	Potable Supply Assessment	Dieldrin distribution, Source characterization, Mode of transport characterization

2.4 Project Authority

This project will be conducted under the Naval Installation Restoration (IR) Program. The IR Program is designed to investigate and remediate uncontrolled hazardous waste disposal sites located on Naval installations and ancillary facilities. IR Program investigations are designed to identify and quantify contamination resulting from past Navy operations and to eliminate existing or potential hazards to public health in an environmentally responsible manner.

The IR Program will be performed in accordance with U.S. Navy management guidance and in compliance with 40 CFR 300, the National Oil and Hazardous Substances Pollution Contigency Plan (NCP), the Resource Conservation and Recovery Act (RCRA) and other applicable or appropriate and relevant requirements. The Department of Defense (DOD) initiated the IR Program as a component of compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) as modified by the Superfund Amendments and Reauthorization Act (SARA).

An IR project is usually implemented by these steps:

1. Records Search. An installation-wide records search, review of past studies and personnel interviews collects evidence of contamination at the installation. The information is then evaluated to determine the potential hazard.

2. Confirmation/Quantification. On-site investigations, physical and chemical analyses determine and quantify the existence, location and level of contamination. Priorities for remedial action are established. Additional investigation, beyond that anticipated, may be necessary to generate sufficient data for the assessment of remedial alternatives; or to eliminate a site from the remediation plan. This phase is generally referred to as the Remedial Investigation (RI) or Preliminary Assessment and Site Inspection (PA/SI).

3. Technical Development. At any time during the project, the need to conduct more intensive monitoring or to examine technologies for the assessment of environmental effects may be identified.

4. Remedial Actions. Control technologies that will comply with DOD, USN, USEPA, and state regulations and policies on hazardous wastes are selected. This usually is done in two steps: design of remedial actions or Remedial Design (RD) and implementation of remedial actions or Remedial Action (RA). The first step is also termed a Feasibility Study (FS). This step, in combination with Task Number 2, would be called a Remedial Investigation/Feasibility Study (RI/FS).

3.0 SITE-SPECIFIC QUALITY ASSURANCE

The purpose of this **QAPP** is to detail the procedures by which the NWFWMD intends to ensure the quality of technical data generated during the investigation at Corry Station. This **QAPP** describes or references the quality assurance/quality control procedures and methods which will be required by the NWFWMD for the Corry Station project. Some procedures and methods in this document may not be necessary for this investigation, but are included because their use is conceivable under some circumstances.

This QAPP attempts to include any procedures which may be essential to maintaining high levels of accuracy, precision, completeness, representativeness, and comparability in sampling and analytical results (See **Section 5.0 -- Quality Assurance Objectives**) for definitions of these concepts). More detailed information may be found in the FDER (now FDEP) Standard Operating Procedures for Laboratory Operations and Sample Collection Activities, September 30, 1992 (FDEP SOPs), and the USEPA, Region IV, Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, February 1, 1991 (EPA SOPs). Further information can be found in the references listed in **Section 17.0 -- References**. Any questions about the procedures described in this document or its appendices will be resolved by consultation between the NWFWMD and the subcontractor.

The NWFWMD will subcontract the work of drilling, field measurements, collection of soil and water samples, delivery of samples to laboratories, sample analysis, etc. The NWFWMD and its designated personnel will oversee performance of all tasks associated with this project. All subcontractors are accountable to the NWFWMD on issues associated with acceptable and timely performance. **Section 4.0** outlines the NWFWMD's organizational structure and the planned organizational structure for the Corry Station investigation, delineating the lines of authority and communication.

The NWFWMD will require that analyses of collected samples be performed by laboratories which have a Comprehensive Quality Assurance Plan (CompQAP) that is currently approved by the Florida Department of Environmental Protection (FDEP). CompQAP approval will have to be maintained throughout the project. The laboratory must be approved for the analysis of any substance anticipated to be sampled at Corry Station (e.g. dieldrin, benzene, PCE, etc.)

In order to maintain consistency in data collection results, the same methods and QA/QC procedures will be used for each site-specific assessment. Accordingly, no site-specific variations in QA/QC are anticipated.

4.0 PROJECT MANAGEMENT PLAN

In performing the soil and ground water contamination investigation of the Corry Station, the NWFWMD will be responsible for the overall management and performance of the field data collection and analysis, and coordination, as needed, with other resource management and regulatory agencies. The following sections outline the NWFWMD's organizational structure and statutory relationship with the other regulatory agencies, and the planned organization structure for performance of the Corry Station investigation.

4.1 NWFWMD Organizational Structure

The Corry Station investigation will be conducted by the Division of Resource Management of the Northwest Florida Water Management District (NWFWMD). This is the NWFWMD's principal technical division, and it has primary responsibility for all programs and projects related to ground water and surface water quality and quantity, engineering services, field services, and environmental and resource planning. Figure 4-1 illustrates the overall organizational structure of the Resource Management Division. Most technical work associated with the investigation will be performed by the division's Ground Water Bureau, with support from the Surface Water Bureau, the Environmental and Resource Planning Bureau, and the Field Services Section.

The NWFWMD has the statutory authority and responsibility to provide for the conservation, protection, management and control of the waters of the state, which include all surface and ground water within the state and such estuarine and coastal waters that lie within jurisdiction of the State of Florida. The Florida Department of Environmental Protection (FDEP) exercises general supervision over state water policy, promulgation and adoption of water resources regulatory programs, and coordination of resource management and protection programs.

The NWFWMD is authorized to engage in such technical evaluations, special projects and programs, and to implement regulatory programs for consumptive uses of water, well construction and surface water management facilities as it deems necessary to conserve, protect and preserve the waters of the state. The NWFWMD's organizational structure is project and program oriented, and provides the flexibility necessary to form multi-disciplinary project teams that include the technical and regulatory staff appropriate for the project and full administrative support for all matters related to financial and contract management.

NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT ORGANIZATIONAL CHART

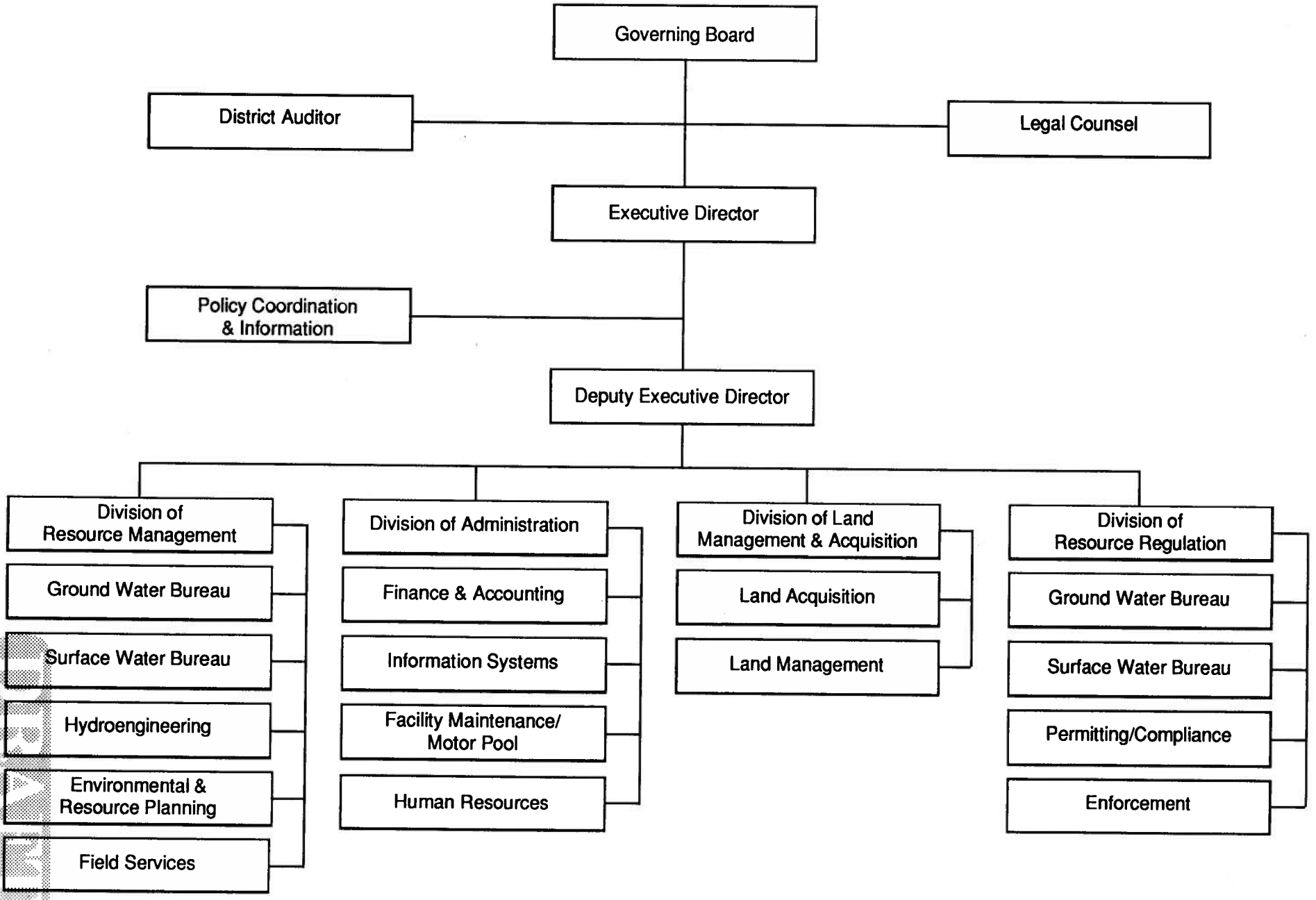


Figure 4-1. NWFWMD Organizational Structure

4.2 Project Organization

The Corry Station investigation will be completed using a combination of NWFWMD staff and subcontractors retained by the NWFWMD to provide specific services. These include; laboratory analysis, drilling services, selected field data collection and specialized consultant services. Procedures for selection of subcontractors are outlined in **Work Plan Section 12.4 -- Subcontractor Selection Procedures**.

Based on previous experience in completing projects performed under contract with state and federal agencies, the NWFWMD has developed a project management structure that includes the following: 1) a senior management or executive officer, 2) Project Director, 3) Project Manager, 4) task leaders responsible for performance of discrete project tasks or elements, 5) Program Administrative Officer, 6) Quality Assurance Officer and 7) technical staff and field personnel assigned to data collection, data management and analysis. In performing the Corry Station investigation, senior NWFWMD staff will be assigned to the key roles of Project Director (Division Director level), and Project Manager (Bureau Chief level). For purposes of this investigation, the Project Director and Program Administrative Officer will report directly to the NWFWMD's Executive Director (Chief Executive Officer).

The proposed organizational structure of the investigation is illustrated in Figure 4-2. A major effort of the Phase II investigation is in field data collection and water quality/soils analyses. Therefore, communication and between the NWFWMD field, supervisory, and quality assurance staff and the subcontractors is emphasized. There will be 2 primary subcontractors; Drilling/Field Data Collection subcontractor and Laboratory Services subcontractor.

A NWFWMD staff member will be Field Supervisor; assigned to supervise the field data collection activities, scheduling of field tasks, and coordinating activities of the 2 primary subcontractors. The Field Supervisor, will provide on-site field oversight during the critical periods of drilling, sampling and other field related activities and report directly to the Task Leader for field data collection. The Field Supervisor will be the field subcontractor's contact and direct link to the NWFWMD. The Field Supervisor will also represent the NWFWMD Quality Assurance Officer (QAO) during daily activities.

The QAO will be responsible for ensuring that the primary subcontractor for field related services adheres to the Quality Assurance Project Plan. The Quality Assurance Officer will also review the quality control/assurance reports from the subcontractor who will perform the laboratory services.

In addition to the primary contractors, a geochemical consultant will be retained to provide an independent quality assurance and guidance to NWFWMD on scientific issues related to colloidal geochemistry.

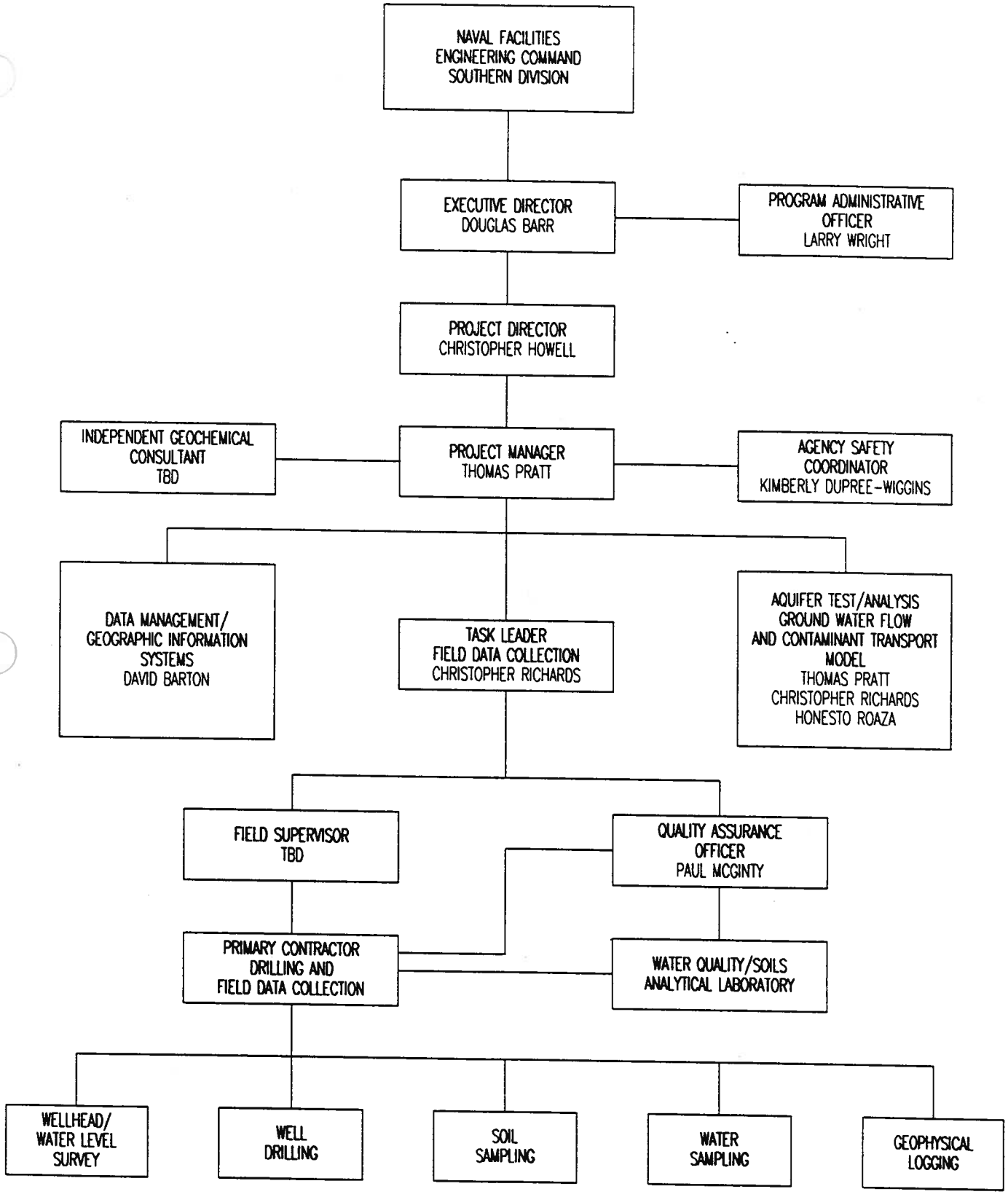


Figure 4-2. Project Organization

4.3 Key Project Personnel

The role and responsibility of the key project personnel for the Corry Station investigation are briefly summarized below. Resumes of the project staff are provided in **Work Plan Appendix D -- Project Personnel Resumes**.

4.3.1 Executive Officer

Mr. Douglas Barr, P.G., NWFWMD Executive Director, will provide policy and executive level assistance to the Project Director and Project Manager in matters relating to approval of contracts and subcontracts, commitment of NWFWMD resources to the investigation, and the development of contracts, negotiated time and fee schedules, and contract amendments. As needed, he will also meet with SOUTHDIV and Corry Station staff to discuss the conduct and performance of the investigation and assist in the resolution of unforeseen problems and implementation of corrective actions.

4.3.2 Project Director

Christopher Howell, Ph.D., will serve as the Project Director and will assume overall responsibility for ensuring that the Corry Station investigation meets the objectives of SOUTHDIV and that the full resources of the NWFWMD are made available for performance of the investigation. He will also have primary responsibility for oversight of the project schedule, providing the necessary level of quality assurance, and serve as the principal point of control between the Project Manager, Program Administrative Officer and SOUTHDIV and Corry Station staff. As needed, the Project Director will also provide for coordination of the program activities with the appropriate state and federal agencies, including the Florida Department of Environmental Protection and the USEPA.

4.3.3 Project Manager

Mr. Thomas Pratt, P.G., will be assigned as Project Manager and will be responsible for overall management and timely completion of the project, including supervision of all technical work elements and tasks associated with completion of the investigation, scheduling of activities to be performed by project staff and/or subcontractors, monitoring and control of the project budget and scope of work, and preparing necessary project progress reports and final reports. Other duties will include:

- development of specific workplans for performance of all principal project

tasks and assignment of task leaders and project staff;

- initiation and performance of all subcontracts for support services in compliance with Chapter 287, Florida Statutes, and monitoring of subcontractor performance and costs as stipulated in the terms of the subcontract;

- providing for regular meetings and contact with SOUTHDIV staff and appropriate staff from Corry Station regarding the progress and status of the program; and

- review and approval of all invoices submitted to the NWFWMD from subcontractors and vendors to ensure that all goods and services were received, and work was performed in accordance with the terms, conditions and specifications of the subcontract.

4.3.4 Task Leader--Field Data Collection

Mr. Christopher Richards, P.G., will serve as the Task Leader for performance of field work and data collection. In this capacity, he will coordinate and review the day-to-day activities of all field data collection staff and subcontractors, and have primary responsibility for the planning management and scheduling of all field investigations. These include surface and subsurface soil sampling, installation of soil borings and monitor wells, proper development of ground water monitor wells, ground water sampling and delivery of samples to the analytical laboratory, and performance of slug tests and single-well and multi-well aquifer tests. In addition, he will have direct responsibility for ensuring that all field data collection activities are performed in accordance with the **QAPP**.

Mr. Richards will be in charge of the on-site Field Supervisor and the Quality Assurance Officer, whose roles are to assist Mr. Richards in adequately serving this primary function. Mr. Richards will also serve as the Site Safety Coordinator. The Task Leader will assist the Project Manager in the planning and development of workplans for performance of all field data collection activities, assuring adequate resources are available for the performance of the field activities, and provide direct support to the Project Manager in monitoring the schedule and budget for the field data collection programs. As needed, the Project Director and Project Manager may designate additional task leaders to coordinate and supervise the performance of other discrete project tasks.

4.3.5 Program Administrative Officer

Mr. Larry Wright will provide administrative services for the Corry Station investigation and will be responsible for all billing activities, final approval and

payment of purchase orders and invoices received from subcontractors and vendors, and provision of program financial reports to the Project Director and Project Manager for purposes of monitoring the program budget and expenditures. In addition, the Program Administrative Officer will be responsible for ensuring compliance with all applicable state and NWFWMD procurement procedures as provided for in Chapters 120, 287 and 373, Florida Statutes, Chapter 40A-1, Florida Administrative Code, and all federal acquisition regulations.

4.3.6 Quality Assurance Officer

The NWFWMD's Quality Assurance Officer is Mr. Paul McGinty. The Quality Assurance Officer will be responsible for ensuring that the **QAPP** for field data collection activities and laboratory analysis are strictly adhered to and enforced. The Quality Assurance Officer will also be responsible for implementation of quality control procedures and will conduct periodic audits of quality assurance procedures, and report the results to the Project Director and Project Manager. As needed, the Quality Assurance Officer will also update and amend the **QAPP**.

4.3.7 Agency Safety Coordinator

The NWFWMD's Agency Safety Coordinator is Ms. Kim Dupree-Wiggins. The Agency Safety Coordinator will be responsible for administrative issues associated with implementation of the Health and Safety Plan. Ms. Dupree-Wiggins will work closely with the Project Manager and the Site Safety Officer during the course of the investigation.

4.3.8 Technical Staff and Field Personnel

Qualified technical and field personnel from the NWFWMD will accomplish specific work elements associated with field data collection, data analysis and report preparation. Technical activity leaders are designated by the Project Director and Project Manager to provide specific expertise for completion of selected project activities and elements. Generally, the technical activity leaders are the senior or most experienced members of the NWFWMD staff in any given technical area of the project. These staff are identified on the project organization chart (Figure 4-2), and their roles and anticipated responsibilities are summarized below.

- Mr. Honesto Roaza, P.G., Associate Hydrogeologist, will provide guidance and assistance in the development and performance of the field data collection program to ensure that all necessary information is obtained for the successful calibration, verification and application of the three-dimensional ground water flow and contaminant transport model to be developed in conjunction with Phase III of the investigation. Mr. Roaza

will also assist in the interpretation of the Phase II field data and development of the conceptual model.

- Mr. David Barton, Director of Information Systems Section, will be responsible for computer services and ARC/INFO Geographic Information System support for the investigation. The computer services include computer resource availability, customized software support, software maintenance and coordination of the GIS staff to provide GIS-related services.

As needed, other staff may be assigned to the project on a short-term basis to provide technical guidance or complete specific task elements. These include Dr. Graham Lewis (Project Biologist), Dr. Pam Latham (Statistical Analyst/Biologist) and Dr. Ruben Arteaga (Computational Hydrologist).

The following is a summary listing of the key project personnel that will be assigned to the Phase II investigation. Revisions and designation of additional personnel may be made prior to initiation of the Phase II investigation.

Northwest Florida Water Management District

Mr. Douglas Barr, Executive Officer
Dr. Christopher Howell, Project Director
Mr. Thomas Pratt, Project Manager
Mr. Christopher Richards, Task Leader--Field Data Collection
Mr. Larry Wright, Program Administrative Officer
Mr. Paul McGinty, Quality Assurance Officer

SOUTHDIV

Mr. David Driggers, Engineer-in-Charge

Activity Environmental Coordinator

Mr. Ron Joyner

5.0 QUALITY ASSURANCE OBJECTIVES

Quality assurance objectives are designed to insure that:

1) sampling will be valid for the objectives of the study;
2) sample handling will preserve the validity of the samples;
3) data treatment will yield a valid representation of the samples adequate to present an accurate picture of the population sampled; and
4) documentation will verify that sampling, sample handing, and data treatment has been done as planned.

The general quality assurance and control goals listed below have been a guide in developing sampling protocols, documentation procedures, and measurement objectives. These objectives should be numerical and statistical where possible. Measurement criteria will be based on site conditions, the purposes of the project, and knowledge of available measurement and analysis capabilities. The use of these measurements in calculations and evaluations is also governed by provisions of this **QAPP**.

When quality assurance instructions are strictly followed during sample collection, handling and analysis, the data produced will be of a known and defensible quality. The QA and QC objectives established by NWFWMD for this project are intended to ensure information of adequate quality and quantity:

- to describe and predict the ground water flow patterns and elevations in the aquifers underlying the Corry Station site and the characteristics of the aquifer matrix;
- to determine the current chemical character of ground water flowing into and out of the aquifers underlying the Corry Station site;
- to form a sound basis for the assessment of each site and to support recommendations for management alternatives; and
- to produce documented, consistent and technically defensible data adequate to fulfill the purpose of the study.

For sample collection and handling, the NWFWMD will use or require the QA/QC procedures of either the FDEP Standard Operating Procedures or the USEPA Standard Operating Procedures. For data management, sample analysis, and data analysis, the NWFWMD will require the procedures of the FDEP SOPs or formulate its own requirements.

5.1 Data Quality Objectives

Data Quality Objectives (DQO) are a classification system by which the likely and appropriate use of data is related to appropriate levels of care and sophistication in data collection and analysis. DQO criteria specify the procedures necessary to insure that data is accurate and precise enough to support the demands of its intended use. DQO criteria include specifications of sampling procedures, equipment materials, decontamination methods, well construction, analytical methods, detection limits, analyte classes, etc.

DQOs are defined in Data Quality Objectives for Remedial Response Activities, EPA/540/G-87/003. The USEPA SOPs recommend that these DQOs be considered when planning any study of environmental contamination. In "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program," the Naval Energy and Environmental Support Activity (NEESA) designates general levels of analytical data quality that are applicable to investigations of naval facilities as E, C, and D (corresponding to USEPA Levels III, IV and V) .

Data resulting from analyses meeting USEPA Level III and IV criteria can be used for site characterization, monitoring during implementation, evaluation of alternatives, engineering design or risk assessment. Level III analyses can be used to detect organics; Level IV analyses can be used to detect analytes on the Hazardous Substances List (HSL) organics, using instrumental analysis, at low parts per billion detection limits.

FDEP SOPs will support either USEPA Level III or IV sample collection and analysis. The site investigations at Corry Station will use USEPA Levels III and IV routinely. Level I (portable field instruments) will be used in conjunction with the analytical sample collection to develop a complete characterization of ground water conditions at Corry Station. It is not anticipated that Level II (tentative, but analyte-specific) methods will be used.

All measurements will be conducted to ensure the analytical results that are representative of the media and conditions measured. Unless otherwise specified, all data will be calculated and reported in units consistent with those used by other organizations reporting similar data to allow comparability of data bases. Data will be reported in micrograms per liter (µg/L) and milligrams per liter (mg/L) for aqueous samples; micrograms per kilogram (µg/kg) and milligrams per kilogram (mg/kg) for soil/sediment samples; or otherwise as applicable.

5.2 Terminology

5.2.1 Accuracy

Accuracy is the degree of agreement of a measurement or the average of several measurements with an accepted reference of "true" value; it is a measure of error or bias in the collection, handling, or analysis of a sample, or in 2 or more of these activities.

5.2.2 Precision

Precision is the degree of mutual agreement among individual measurements of a given parameter under the same conditions. Precise analyses may not be accurate, but may differ from the real value by a consistent amount.

5.2.3 Completeness

Completeness is a measure of the amount of valid data obtained from measurements and analysis compared to the amount expected to be obtained under normal conditions. Incomplete results may arise due to such factors as insufficient sample volume for analysis or damage to samples during shipment.

5.2.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population. Careful choice and use of appropriate methods in the field will increase the representativeness of samples. This is relatively easy with water or air samples if these media are homogeneous. In contrast, soil and sediment contaminants are unlikely to be evenly distributed, and hence it is important for the sampler and analyst to exercise good judgment when collecting a sample.

5.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another.

5.3 Measurement of Analytical Data Quality

5.3.1 Accuracy

The accuracy of a particular analysis is measured by assessing its performance with "known" (or control) samples. These "knowns" can be USEPA-traceable standards (usually spiked into a pure water matrix); commercial laboratory-prepared solutions of target analytes in a water or solid matrix; or (in the case of GC or GC/MS analyses) solutions of surrogate compounds which can be spiked into every sample and are designed to mimic the behavior of target analytes without interfering with their determination. In each case, the recovery of the analyte is measured as a percentage, correcting for analytes known to be present in the original sample if necessary (as in the case of a matrix spike analysis). For commercial or USEPA-supplied known solutions, this recovery is compared to the data that accompany the solution. For surrogate compounds, recoveries are compared to information obtained from either the commercial lab or from the USEPA Certified Laboratory Program (CLP) acceptable recovery tables.

If recoveries do not meet the required criteria, then the analytical data for the batch (or, in the case of surrogate compounds, for the individual sample) are considered potentially inaccurate. Investigation of the cause of the problem and corrective action will follow the procedures of **Section 15.0 -- Corrective Actions** and **Section 11.0 -- FDEP SOPs**. The laboratories performing analyses will be expected to conduct routine accuracy checks as specified in the laboratory Quality Assurance Project Plan and by **Section 9.0 -- FDEP SOPs**.

5.3.2 Precision

The precision of a particular analysis is measured by assessing its performance with duplicate or replicate samples. Duplicate samples are pairs of samples collected in the field at the same time/location and transported to the laboratory as distinct samples. For most purposes, precision is determined by the analysis of replicate pairs (i.e., 2 samples prepared at the laboratory from one original sample). Replicate pairs of spiked samples, known as matrix spike/matrix spike duplicate samples, should be used for precision studies.

Precision is calculated in terms of Relative Percent Difference (RPD), which is expressed as follows:

Relative Percent Difference (RPD)

$$RPD = \frac{|A - B|}{A+B} \times 200$$

Where: A = concentration in sample A
B = concentration in sample B

RPDs (or other appropriate equations, see **Section 9.0 -- Minimum Quality Control Requirements and Routines to Calculate and Assess Precision and Accuracy**) must be compared to the QC acceptance criteria or control limits specified for the method by the laboratory Quality Assurance Project Plan. The laboratory must investigate the cause of RPDs that fall outside stated acceptance limits. Reports of results of laboratory investigations will be included in periodic reports to the NWFWMD on quality assurance.

5.3.3 Completeness

Completeness for each parameter is calculated as follows:

$$\text{Completeness} = \frac{\text{Number of successful analyses}}{\text{Number of requested analyses}} \times 100.$$

NWFWMD's target value for completeness is 100 percent for all parameters; however, a completeness value of 95 percent is considered acceptable. Incomplete results for requested analyses will be reported to the EIC in the quarterly progress reports.

5.3.4 Representativeness

The characteristic of representativeness is not quantifiable. Subjective factors that must be taken into account are as follows:

- The degree of site homogeneity;
- The degree of homogeneity of a sample taken from one point on a site; and
- The information on which a sampling plan is based.

To maximize representativeness of results, sampling techniques and sample locations are carefully chosen so that they provide laboratory samples representative of both the site and the specific area. Within the laboratory, precautions are taken to extract from the sample bottle an aliquot representative of the whole sample. This includes premixing the sample in the sample container and discarding large pebbles from soil samples.

5.4 QA/QC Targets

Target values for detection limit, percent spike recovery, RPD of duplicates/replicates, etc. will be those cited in **Section 6.5.2 -- Ground Water Sample Collection**. It is important to note that tabulated values are not always attainable. For example, high contaminant concentrations, sample nonhomogeneity, and matrix interferences can preclude achievement of target detection limits or other QC criteria. In such instances, the quarterly project report to the EIC will indicate the occurrence and cause of any deviation from the tabulated detection limits or any other noncompliance with specified QC criteria.

6.0 FIELD MEASUREMENTS AND SAMPLING

The field measurement and sampling procedures to be followed, and precautions to be required throughout the Corry Station NTTC investigation are described or referenced in the following sections. Also included are the instructions necessary for associated activities, such as equipment decontamination, if sampling is to achieve its quality objectives. Sampling procedures for different media, sample preservation, field QA/QC sample practices, and equipment decontamination will generally follow the Standard Operating Procedures for Laboratory Operations and Sample Collection Activities of the FDEP (**FDEP SOPs**).

Site assessments will include soil and sediment sampling, and ground water sampling from surficial and main-producing zone monitoring wells. Public supply wells will be subject to sampling, purge water sampling and GAC backwash sampling.

The field measurement procedures described below summarize those found in **Section 7.0 -- FDEP SOPs**. The sampling procedures are a condensed version of those found in **Section 4.0 -- FDEP SOPs**, which should be consulted for complete details if there is any doubt as to the exact procedure to be used in a particular circumstance. All sampling references must be available in the field for consultation.

6.1 Field Parameter Measurements

Field measurements of pH, temperature, dissolved oxygen, and specific conductivity will be made using a flow-through cell. This device allows a more representative reading of these ground water parameters and minimizes changes in the test water caused by exposure to the atmosphere.

Field measurements of pH, temperature, dissolved oxygen, and specific conductivity shall be determined and recorded as a part of the well purging procedure. Once the purge discharge line has been connected to the flow-through cell and the meters have been calibrated, recording of field parameters shall begin. Field parameters shall periodically be recorded in the field notebook, during the course of purging. When the field parameters have stabilized and purging is complete, the final set of field parameter values shall be recorded in the field notebook. Purge beginning and ending times shall also be recorded. Field parameters for public supply wells shall be determined in a similar manner (i.e. via use of a flow-through cell until values stabilize).

A discussion of the calibration and use of individual meters is provided in **Section 13.0 -- Calibration Procedures and Frequency.**

6.1.1 Organic Vapor Meters and Field Screening for Organics

A soil head space survey will be conducted by screening selected samples in the field for volatile organics using a Flame Ionization Detector (FID) organic vapor analyzer (OVA) in the survey mode. The screening process is as follows:

- A water bath or ice chest is prepared to provide a medium in which to equilibrate the temperature of screening samples collected.

- Samples are collected by filling 2 16-oz jars with soil to half the container volume, and promptly capped.

- Following collection, each sample is promptly placed into the temperature equilibrating medium. As a general rule, headspace readings will be taken after the samples have equilibrated at 70° F for a time period of 5 minutes.

- At the end of the equilibration period for each sample, the container lid is removed to allow the insertion of the OVA prove. The readings obtained on the OVA in ppm will be recorded in the field notebook. OVA readings will be distinguished as peaks, sustained or unstable depending on the response observed.

- One sample will be measured with a carbon-tip filter attached to the OVA probe, and the other sample will be measured with no carbon-tip filter. Both readings obtained on the OVA in ppm will be recorded in the field notebook. The carbon filter will allow naturally occurring methane to be distinguished from other volatile organics.

- The OVA screening is conducted in a sheltered area, affording protection from the potentially adverse affects of wind, precipitation and direct sunlight.

- Because atmospheric conditions are dynamic, fluctuating to some degree during the course of a day, pertinent information such as ambient temperature, percent humidity and periods of sunlight to cloudiness will be recorded during the screening investigation. These conditions will be monitored, equilibration times adjusted, and OVA measurements evaluated, taking into consideration atmospheric fluctuations.

Use of the FID OVA is further discussed in **Section 13.3.6 -- Organic Vapor Meters** and in **Work Plan Section 8.5 -- Soil Headspace Survey**.

6.2 Sampling Equipment Decontamination and Cleaning

Sufficient clean equipment should be transported to the field so that an entire weeks worth of sampling can be conducted without the need for field cleaning. All field sampling equipment shall be precleaned in-house (office, lab, or base of field operations) prior to arrival on-site. In-field cleaning and decontamination shall be documented in the field records. These records shall specify the type of equipment that is cleaned and the specific protocols that are used (reference to SOPs and **QAPP** for the cleaning protocols is acceptable).

All field sampling equipment that comes in contact with the sample must be cleaned/decontaminated before use. The procedures that are applicable to the field sampling equipment used in this project are outlined below. Laboratory equipment cleaning procedures are detailed in the laboratory Quality Assurance Project Plan.

6.2.1 Cleaning Liquids and Solvents

All detergents, solvents, analyte-free water, and acids needed for field sampling operations shall be provided by the subcontractor responsible for this activity.

Detergents -- Detergents specified in this document refer to Liquinox (or equivalent).

Solvents -- Solvents used in routine cleaning procedures shall be pesticide grade or nanograde isopropanol. Pesticide grade and nanograde are synonymous.

Analyte-free water -- Analyte-free water sources shall be subject to the following criteria:

a. Analyte-free water is water in which all analytes of interest and all interferences are below method detection limit.

b. This type of water shall be obtained from a reputable source and documentation shall be maintained to demonstrate reliability and purity of analyte-free water sources (i.e. results from field and equipment blanks). As a general rule, the following types of water should be used:
   1. Milli-Q (or equivalent) - suitable for all analyses
   2. Organic-free - may be suitable for only VOCs and extractable organics
   3. Deionized water - only for inorganic analyses (metals, nutrients, etc.)

c. Analyte-free water shall always be used for blank preparation and for the final in-house decontamination rinse.

d. Analyte-free water shall be transported to the field in containers of suitable construction.

Acids -- All acids used for cleaning and preservation shall be reagent grade or better.

10 percent hydrochloric acid is prepared by mixing 1 part concentrated hydrochloric acid with 3 parts deionized water. 10 percent nitric acid is prepared by mixing 1 part concentrated nitric acid with 5 parts deionized water.

6.3 Decontamination/Cleaning Procedures for Sampling Equipment

Once cleaned, sampling equipment shall be wrapped and sealed to prevent contamination during storage or transport from or to the field. Decontaminated field equipment shall be protected from environmental contamination by securely wrapping and sealing with aluminum foil (grocery store foil is acceptable). Clean, disposable plastic bags may be used if the equipment is first wrapped in foil. Containers are capped with aluminum, Teflon film, or their cleaned lids.

All spent cleaning solutions and solvents generated by field decontamination shall be disposed of in the following manner. Waste soapy water, tap water, deionized water, rinse water and acid rinse solutions shall be collected in a 5 gal plastic container and disposed of to the sanitary sewer system serving Corry Station, at an access point designated by the Activity Environmental Coordinator. Waste aqueous solutions shall be disposed of on a daily basis. Spent isopropanol shall be collected in a separate 5 gal plastic container and allowed to volatize on site.

6.3.1 In-field Cleaning of Teflon Bailers and Other Teflon Equipment

Frequency -- Prior to second and all subsequent uses of equipment in field.

1. Clean with tap water and lab grade soap (Liquinox or equivalent) using a brush, if necessary, to remove particulate matter or surface film. Do not clean visibly heavily-contaminated equipment in the field. Such rigorous cleaning procedures should be performed at the base of operations.

2. Rinse thoroughly with tap water.

3. Rinse with 10-15 percent reagent grade nitric acid (HNO_3) or 10-15 percent reagent grade hydrochloric acid (HCl).

4. Rinse thoroughly with deionized water (DI). Enough water shall be used to ensure that all equipment surfaces are flushed with water.

5. Rinse twice with isopropanol. One rinse may be used as long as all equipment surfaces are thoroughly wetted with free-flowing solvent.

6. Rinse thoroughly with analyte-free water (**Section 6.2.1 -- Cleaning Liquids and Solvents**) and allow to air dry as long as possible.

7. Cleaned equipment shall be wrapped (if appropriate) in aluminum foil to prevent contamination during handling and transport.

8. If no further sampling (and by inference, in-field cleaning) is to be performed with a given piece of equipment prior to returning to base of operations, equipment must be rinsed with tap water immediately after use.

6.3.2 In-house Cleaning of Teflon Bailers and Other Teflon Equipment

Frequency -- Prior to transport of equipment to field.

Rigorous cleaning procedures should be performed at the base of operations, in a contaminant-free environment. Cleaning protocols are as per **Section 6.3.1** above, with the exception that:

1. Hot tap water is substituted for tap water (Steps 1 and 2 of **Section 6.3.1**).
2. Clean equipment is allowed to air dry overnight (Step 6 of **Section 6.3.1**).
3. It is always appropriate to wrap cleaned, dry equipment in aluminum foil (Step 7 of **Section 6.3.1**).

In the case of heavily-contaminated equipment the following additional protocols may be required to effect in-house cleaning, before commencing Steps 1 through 7 in **Section 6.3.1** above.

1. Prerinse equipment using the following solvents in the order described: acetone-hexane-acetone.

2. Wash, scrub if necessary, in hot tap water and detergent solution. In extreme cases, it may be necessary to steam-clean the field equipment before proceeding with the next step.

3. If the field equipment cannot be cleaned utilizing these procedures, it should be discarded, unless further cleaning with stronger solvents and/or oxidizing solutions are effective.

6.3.3 In-field Cleaning of Stainless Steel Equipment

Frequency -- Prior to second and all subsequent uses of equipment in field.

Cleaning protocols are as per **Section 6.3.1** above, with the exception that:
1. No acid rinse is used (Step 3 of **Section 6.3.1**).
2. If no further sampling (and by inference, in-field cleaning) is to be performed with a given piece of equipment prior to returning to base of operations, equipment must be rinsed with tap water immediately after use.

6.3.4 In-house Cleaning of Stainless Steel Equipment

Frequency -- Prior to transport of equipment to field.

Cleaning protocols are as per **Section 6.3.2** above, with the exception that:
1. No acid rinse is used (Step 3 of **Section 6.3.1**).

6.3.5 In-field Cleaning of Analyte-free Water Containers

Frequency -- Procedure is not performed in field.

6.3.6 In-house Cleaning of Analyte-free Water Containers

Frequency -- Prior to refilling.

Cleaning protocols are as per **Section 6.3.2** above, with the exception that:
1. In the case of a high density polyethylene or polypropylene container, delete Step 5 of **Section 6.3.1.**
2. Step 7 of **Section 6.3.1** is not performed (wrap with aluminum foil).

Analyte-free Water Container caps shall be equipped with a Teflon liner.

6.3.7 In-field Cleaning of Sample Containers

Frequency -- Procedure is not performed in field.

6.3.8 In-house Cleaning of Sample Containers

Frequency -- Prior to transport of containers to field.

The cleaning procedures used for sample containers are described in the laboratory Quality Assurance Project Plan. Any containers that appear to be dirty should be disposed of or returned to the laboratory. Occurrence of visibly dirty or contaminated sample containers should be recorded in the field notebook.

6.3.9 In-field Cleaning of Submersible Purge Pump and Teflon Purge Tubing

Frequency -- Prior to second and subsequent uses of equipment in field.

1. Disconnect purge pump and Teflon purge tubing from "non-inert" purge tubing. Pump a sufficient amount of soapy water through pump and Teflon purge tubing to flush out any residual purge water.

2. Using a brush, scrub the exterior of the Teflon purge tubing and pump with soapy water. Rinse soap from the outside of the purge tubing and pump with tap water.

3. Pump a sufficient amount of tap water through the purge tubing to flush out soapy water.

4. Pump a sufficient amount of deionized water through the hose to flush out the tap water.

5. Rinse the outside of the pump housing and purge tubing with deionized water (approximately 1/4 gallon).

6. Place equipment in a clean polyethylene bag, or wrap in polyethylene film or aluminum foil to prevent contamination during storage or transit.

6.3.10 In-house Cleaning of Submersible Purge Pump and Teflon Purge Tubing

Frequency -- Prior to transport of equipment to field.

1. Disconnect purge pump and Teflon purge tubing from "non-inert" purge tubing. Pump a sufficient amount of hot, soapy water through pump and Teflon purge tubing to flush out any residual purge water.

2. Using a brush, scrub the exterior of the Teflon purge tubing and pump with hot, soapy water. Rinse soap from the outside of the purge tubing and pump with hot tap water.

3. Pump a sufficient amount of tap water through the purge tubing to flush out soapy water.

4. Pump a sufficient amount of deionized water through the hose to flush out the tap water.

5. Rinse the outside of the pump housing and purge tubing with deionized water (approximately 1/4 gallon).

6. Place equipment in a clean polyethylene bag, or wrap in polyethylene film or aluminum foil to prevent contamination during storage or transit.

6.3.11 In-field Cleaning of "Non-inert" Purge Tubing

Frequency -- Procedure not performed in field.

6.3.12 In-house Cleaning of "Non-inert" Purge Tubing

Frequency -- Prior to transport of equipment to field.

1. Connect purge pump and Teflon purge tubing to non-inert purge tubing. Pump a sufficient amount of hot, soapy water through entire ensemble to flush out any residual purge water.

2. Uncoil all tubing from spool. Using a brush, scrub the exterior of all tubing and pump with hot, soapy water. Rinse soap from the outside of all purge tubing and pump with hot tap water. Rinse hose with deionized water and recoil onto spool.

3. Pump a sufficient amount of tap water through the purge tubing to flush out soapy water.

4. Pump a sufficient amount of deionized water through the hose to flush out the tap water.

5. Rinse the outside of the pump housing and purge tubing with deionized water.

6. Place equipment in a clean polyethylene bag, or wrap in polyethylene film or aluminum foil to prevent contamination during storage or transit.

6.3.13 In-field Cleaning of Water Level Measurement Devices

Frequency -- Prior to second and subsequent uses of equipment in field.
1. Wash with laboratory detergent and tap water.
2. Rinse with tap water.

3. Rinse with deionized water.
4. Allow to air dry as long as possible.

6.3.14 In-house Cleaning of Water Level Measurement Devices

Frequency -- Prior to transport of equipment to field.
1. Wash with laboratory detergent and tap water.
2. Rinse with tap water.
3. Rinse with deionized water.
4. Allow to air dry overnight.
5. Cleaned equipment shall be wrapped in aluminum foil to prevent contamination during handling and transport.

6.3.15 In-field Cleaning of Flow-through Cell for Field Parameters

Frequency -- Procedure is not performed in field.

6.3.16 In-house Cleaning of Flow-through Cell for Field Parameters

Frequency -- Prior to each mobilization.
1. Wash with laboratory detergent and tap water.
2. Rinse with tap water.
3. Rinse with deionized water.
4. Allow to air dry overnight.

6.3.17 In-field Cleaning of Reusable Bailer Lanyards

Frequency -- Prior to second and subsequent uses of equipment in field. Cleaning protocols are as per **Section 6.3.3** above.

6.3.18 In-house Cleaning of Reusable Bailer Lanyards

Frequency -- Prior to transport of equipment to field. Cleaning protocols are as per **Section 6.3.4** above.

6.4 Sample Collection -- General Considerations

Since the concentration standards and/or guidance criteria for the analytes targeted by this investigation are in the parts per billion range, extreme care must be taken to prevent cross-contamination. Samples shall be collected from the least to the most contaminated sampling locations within a site (if known). Unless field conditions justify other sampling regimens, samples shall be collected in the following order:

a. Volatile Organic Contaminants (VOCs)
b. Extractable Organics [includes pesticides]
c. Metals
d. Organic Carbon, Inorganics and Physical Properties

Ambient or background samples shall be collected first (if known) and placed in separate ice chests or shipping containers from more highly contaminated samples (if known). It is a good practice to enclose highly contaminated samples in a plastic bag before placing them in ice chests. Ice chests or shipping containers with samples suspected of being highly contaminated shall be lined with new, clean, plastic bags. If possible, one member of the field team should take all the notes, fill out tags, etc., while the other member does all of the sampling.

Protective gloves shall be worn during all purging and sample collection activities. Gloves shall not come into contact with the sample, the interior of the container or lip of the sample container. New, disposable, unpowdered latex gloves which are changed and discarded after every phase of purging and sampling shall be used.

All fuel-powered equipment activities must be placed away from and downwind of any site activities (e.g. purging, sampling, decontamination). If field conditions preclude such placement, the sampling activities shall be conducted as far away as possible from the fuel source(s) and the field notes must describe the conditions. If possible, fuel handling should be done prior to the sampling day. If such activities must be performed during sampling, the personnel must wear disposable gloves. All fuel dispensing activities and glove disposal shall occur downwind and well away from the sampling activities.

6.5 Ground Water Sampling

6.5.1 Purging

To ensure a representative ground water sample from a monitor well, the well must be purged prior to sampling. As a part of Phase II sample collection, both dedicated and non-dedicated pumps will be used to purge wells. Dedicated pumps will be used to purge the Corry Station public supply wells. Purging of these wells is discussed in **Section 6.5.2.3 -- Sampling Wells with In-Place Plumbing**. Contractor-supplied, non-dedicated pumps will be used to purge monitor wells constructed as a part of Phase II. Purging of these wells is discussed below.

6.5.1.1 Purge Pumps

Refer to Table 6-1 for details of pump types and construction materials recommended for purging in different situations. Decontamination of purging equipment is discussed in **Section 6.3 -- Decontamination/Cleaning Procedures for Sampling Equipment.**

a. Peristaltic pumps, positive-displacement bladder pumps (no-gas contact), bladderless purge pumps, and hand pumps shall not be used to purge wells.

b. Centrifugal pumps can be utilized to purge wells having a static water level less than 20 ft bls. Care must be taken so that purged water does not fall back into the well casing. Disposable gloves (**Section 6.4 -- Sample Collection -- General Considerations**) shall be worn and discarded after positioning the pump. New disposable gloves shall be put on prior to sampling.

c. Submersible pumps can be utilized for purging 2-in or greater diameter monitor wells. The pump must be constructed of stainless steel and/or Teflon material and the delivery hose shall be constructed of appropriate material (Table 6-1). The delivery hose shall be fitted with inert stainless steel or Teflon tubing between the pump and "other non-inert tubing" to be able to purge wells that will be sampled for trace organics.

d. The use of bailers is not allowed for purging.

TABLE 6-1

SAMPLING EQUIPMENT -- CONSTRUCTION AND APPROPRIATE USE

Equipment Type	Construction		Use	Permissible Parameter Groups	Restrictions And Precautions
GROUND WATER SAMPLING					
Positive Displacement Pumps					
Submersible (turbine, helical rotor, gear driven)	Housing (c) SS, Teflon	Tubing (c) SS, Teflon	Purging	All parameter groups	f; in-line, one-way SS or Teflon check valve required
			Sampling	Sampling not allowed w/ non-dedicated pump	a
	SS, Teflon	Non-inert(d)	Purging	All parameter groups	f; in-line, one-way SS or Teflon check valve required; polishing required (e)
			Sampling	Sampling not allowed w/ non-dedicated pump	a
Submersible (turbine, helical rotor, gear driven)	Housing (c) Non-inert	Tubing (c) Non-inert	Purging	Purging not allowed w/ non-dedicated, non-inert pump	b
			Sampling	Sampling not allowed w/ non-dedicated pump	a
Suction Lift Pumps					
Centrifugal	N/A	SS, Teflon	Purging	All parameter groups	SS or Teflon foot-valve required
	N/A	Non-inert(d)	Purging	All parameter groups	SS or Teflon foot-valve required; polishing required (e)
Bailer	Teflon		Purging	Purging not allowed w/ bailer	
			Sampling (k)	All parameter groups	none
	SS, Non-inert		Purging	Purging not allowed w/ bailer	
			Sampling	Sampling not allowed w/ SS or non-inert bailer	

TABLE 6-1
(continued)

SAMPLING EQUIPMENT -- CONSTRUCTION AND APPROPRIATE USE

Equipment Type	Construction	Use	Permissible Parameter Groups	Restrictions And Precautions
SEDIMENT/SOILS SAMPLING				
Core Barrel (or liner)	SS, Teflon, Glass Teflon-coated, or Aluminum	Sampling	All parameter groups	g,h,i
	Non-inert		Physical parameters	none
Scoop, spoon or spatula	SS, Teflon or Teflon-coated	Sampling and compositing	All parameter groups	VOC samples may not be taken from composite samples
	Non-inert		Physical parameters	none
Mixing Tray (Pan)	SS, Teflon, Glass, Teflon coated, or Aluminum	Compositing or homogenizing	All parameter groups (except VOCs)	VOC samples may not be taken from composite samples
	Non-inert		Physical parameters	none
Shovel, Hand auger, Bucket auger, trowel	SS	Sampling	All parameter groups	none
	Non-inert		Physical parameters	none
Split spoon	SS or carbon steel w/ Teflon insert	Sampling	All parameter groups	g,h
Shelby tube	SS	Sampling	All parameter groups	g; VOC samples shall be taken from the core interior
	Carbon steel		Physical parameters	none

KEY TO RESTRICTION AND PRECAUTIONS

a. Pumps may not be used for sampling except when pumps are permanently installed as a part of a drinking water system. If installed as a part of a drinking water system, the material construction of the pump must be noted in the field documentation (if known). In this case of a dedicated pump system, sampling for all parameter groups (including VOCs) is permissible.

b. In the case of a permanently-installed pump which is a component of a drinking water system, purging with a pump composed of non-inert materials is acceptable.

c. This category refers to tubing and pump housing/internal parts that are in contact with purged water.

d. "Non-inert pertains to materials which are reactive (adsorb, absorb, etc.) to the analytes being sampled. Such materials include: polyethylene, PVC, and other plastics if organics are of interest and metallic equipment (brass, galvanized, and carbon steel, etc.) if trace metals are of interest. In the case of a non-dedicated pump system and non-inert purge tubing, there shall be a 5 to 10 ft length of inert tubing (SS or Teflon) between the pump and the non-inert tubing. Only this tubing shall come in contact with well water and the tubing shall be cleaned as per the pump between each well.

e. "Polishing": When purging for organics, the entire length of tubing, or that part which comes in contact with the formation water, shall be constructed of Teflon or SS. If non-inert materials are used, the following procedures must be followed: 1) contact with formation waters is minimized by slowly lowering the purge pump into the water column during the purging, thus keeping the pump near the top of the water column and minimizing the possibility of contact between the non-inert tubing and the water column; 2) a single well volume must be removed with the purge pump subsequent to completion of purging and before sampling begins. Tygon purge tubing must never be used for purging when organics are of interest.

f. If used as a non-dedicated system, the pump must be completely cleaned between wells.

g. If samples are sealed in the liner for transport to the laboratory, the sample for VOC analysis must be taken from the interior part of the core.

h. Liners must be constructed of stainless steel or a suitable non-metallic material. If a metallic (carbon steel, aluminum) liner is used with the core barrel, the samples for metals shall be taken from the interior part of the core sample.

i. Aluminum foil, trays, or liners may be used if aluminum is not an analyte of interest.

j. Physical parameters consist of grain size analysis and laboratory permeability testing

k. Bailers used for VOC sampling shall be equipped with a control-flow bottom and a positive displacement filtration system.

ACRONYMS:

N/A	not applicable	PVC	polyvinyl chloride
SS	stainless steel	VOC	volatile organic compound
HDPE	high density polyethylene		

6.5.1.2 Water Level and Purge Volume Determination

Prior to opening a wellhead for purging and sampling, all standing water around the top of the well casing must be removed. Inspect the exterior protective casing for damage and document accordingly.

To calculate the purge volume, the water level is determined by using an electronic probe, chalked tape, etc. The depth below designated measurement point shall always be recorded to the nearest 0.01 ft from the same reference or survey mark on the well casing. A minimum of two readings which yield the same vertical distance shall be taken (and recorded) to ensure accuracy. The total water column length is obtained by subtracting the depth to the top of the water column from the total depth of the well.

To calculate well water volume the following equation is used:

$$V = K D^2 H$$

Where V = volume in gallons;
K = (Pi/4)(7.48 gallons/cubic foot) = 5.87;
(Pi = 3.14159);
D = well casing diameter in feet; and
H = height of the water column in feet.

Record all measurements in the field records. Decontaminate all measuring devices immediately after use according to **Section 6.3.13 -- In-field Cleaning of Water Level Measurement Devices.**

6.5.1.3 Purging Criteria

Purging is considered complete if any 1 of these conditions is satisfied: 3 well volumes are purged and field parameters stabilize; or at least 5 well volumes are purged or at least 1 fully dry purge. "Stabilization" of field parameters means consecutive readings taken at least 5 min apart are within 5 percent of each other.

Except for "low recovery" wells, all wells shall be sampled immediately upon completion of purging. "Low recovery" wells or wells that have been purged completely dry may be sampled as soon as sufficient sample matrix is available or up to 10 hrs after purging.

6.5.1.4 Well Purging Techniques

Equipment selection must comply with construction and configuration requirements specified in Table 6-1. A clean protective covering may be placed around the

wellhead during purging activities. If this protective covering becomes soiled, ripped, etc. it must be replaced prior to sampling. The total amount of purge water discharged must be measured during the purging operation and recorded. The flow rate shall be determined by collecting purge water in a container of known volume and determining the length of time required to fill the container. Record the time that actual purging begins and ends in the field records.

In general, when non-dedicated pumps are used for purging, the purging process shall be done with the pump as near to the top of the water column as possible to ensure that no stagnant water remains in the well above the pump after purging.

Fuel-driven centrifugal pumps must be placed at least 10 ft from the wellhead and downwind of the well. Disposable gloves shall be worn and discarded after positioning the pump. New gloves shall be put on prior to sampling. If the centrifugal pump rate exceeds the recovery rate of the well then the hose should be lowered into the well as needed to accommodate the drawdown. The suction hose must have a foot valve installed to prevent purge water from re-entering the well.

Electric submersible pumps should be set as near the top of the water column as possible to ensure that all stagnant water in the casing is removed and to minimize the contact area of the delivery hose with water column.

6.5.2 Ground Water Sample Collection

This discussion of ground water sampling techniques will outline the use of bailers, sampling of monitoring wells, and public supply wells. The alternative devices for sampling different matrices, required construction materials for different parameter groups, and restrictions and precautions to be observed during sample collection are listed in Table 6-1. Cleaning and decontamination of sampling equipment is discussed in **Section 6.3 -- Decontamination/Cleaning Procedures for Sampling Equipment**. It is recommended that the same sampling crew perform all sampling, to minimize personnel handling variation. Ground water parameters to be collected during the course of Phase II are found in Table 6-2.

6.5.3 Sample Containers, Preservation and Holding Times

Required ground water sample containers for different parameters are listed in Table 6-3. All samples shall be preserved according to the requirements specified in Table 6-3. Holding times to be observed are also included in Table 6-3. For those samples requiring it, samples shall be preserved immediately upon collection. USEPA has defined "immediate" as "within 15 min of sample collection". This definition shall apply to all sample preservation.

VOC vials shall be subjected to a special handling procedure prior to filling. This procedure shall be performed by the subcontractor performing the sample collection.

a Place VOC vials, caps, and teflon septa in a laboratory oven set at 70° C for at least 24 hrs;

b Immediately prior to sampling trip, remove vials from oven, allowed to cool for a minute in a contaminant-free environment;

c Insert teflon septa into plastic caps (Teflon side toward vial) and screw cap onto vials;

d Place enough prepared vials for one sample into a ziplock bag, then place bag into a new, unused paint can, fill can with vermiculite and place lid securely on can;

e New unpowdered latex gloves shall be worn during all phases of this procedure.

The purpose of this procedure is to minimize the potential for vial contamination. Trip blanks shall be prepared at the time this procedure is performed, since this procedure "restarts" the clock on the vials. To prepare trip blanks for VOC sampling: fill a number of baked vials equal to the number that constitute one sample; fill with VOC-free water (leaving no headspace); place blanks in a ziplock bag and then in a can; pack with vermiculite and seal. Prepare only 1 set of trip blanks for each cooler used to transport VOC samples.

TABLE 6-2

SAMPLING PARAMETER LISTS

GROUP A SAMPLING PARAMETER LIST

Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range %	Prcsn % RPD	MDL	PQL
Total Organic Carbon	415.1	415.1	w	80 - 120	<20	1 mg/L	2 mg/L
Residue, Filtrable	160.1	160.1	w	80 - 120	<20	2 mg/L	2 mg/L
Residue Non-Filtrable	160.2	160.2	w	80 - 120	<20	10 mg/L	10 mg/L
Residue, Total	160.3	160.3	w	80 - 120	<20	10 mg/L	10 mg/L
Turbidity	n/a	180.1	w	80 - 120	<20	0.5NTU	0.5NTU

Matrices are denoted as follows:

w: ground water
s: soil and sediment

RPD is the relative percent difference.

MDL is the Method Detection Limit, which is defined as the minimum concentration of an analyte that can be measured by the method with 99 percent confidence of its presence in the sample matrix.

PQL is the Practical Quantitation Limit, which is the lowest level of concentration that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions.

TABLE 6-2
(continued)

SAMPLING PARAMETER LISTS

GROUP B SAMPLING PARAMETER LIST

Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range %	Prcsn % RPD	MDL µg/L	PQL µg/L
Aldrin	3510	608	w	14 - 90	<44	0.01	0.05
Alpha-BHC	3510	608	w	59 - 103	<25	0.01	0.05
Beta-BHC	3510	608	w	84 - 112	<11	0.02	0.10
Delta-BHC	3510	608	w	34 - 122	<20	0.01	0.05
Gamma-BHC	3510	608	w	72 - 108	<17	0.01	0.05
Chlordane Technical	3510	608	w	45 - 119	<50	0.10	1.0
p,p'-DDD	3510	608	w	80 - 116	<10	0.02	0.05
p,p'-DDE	3510	608	w	61 - 117	<15	0.02	0.1
p,p'-DDT	3510	608	w	80 - 138	<17	0.02	0.1
Dieldrin	3510	608	w	89 - 113	<11	0.02	0.1
Endosulfan I	3510	608	w	73 - 136	<30	0.01	0.05
Endosulfan II	3510	608	w	95 - 125	<10	0.01	0.10
Endosulfan Sulfate	3510	608	w	85 - 117	<10	0.02	0.1
Endrin	3510	608	w	30 - 147	<50	0.02	0.1
Endrin Aldehyde	3510	608	w	88 - 128	<23	0.02	0.14
Heptachlor Epoxide	3510	608	w	78 - 124	<20	0.01	0.10
Methoxychlor	3510	608	w	77 - 149	<18	0.05	0.4
Toxaphene	3510	608	w	41 - 126	<50	0.5	1
PCB 1016	3510	608	w	49 - 137	<15	0.2	1
PCB 1232	3510	608	w	60 - 110	<50	0.2	1
PCB 1248	3510	608	w	60 - 110	<50	0.2	1
PCB 1254	3510	608	w	60 - 110	<50	0.2	1
PCB 1260	3510	608	w	61 - 125	<10	0.2	1
Chlorothalonil	3510	608	w	36 - 128	<30	0.02	0.20
Permethrin	3510	608	w	70 -125	<50	0.20	0.50

Matrices are denoted as follows:

w: ground water
s: soil and sediment

RPD is the relative percent difference.

MDL is the Method Detection Limit, which is defined as the minimum concentration of an analyte that can be measured by the method with 99 percent confidence of its presence in the sample matrix.

PQL is the Practical Quantitation Limit, which is the lowest level of concentration that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions.

TABLE 6-2
(continued)

SAMPLING PARAMETER LISTS

GROUP C SAMPLING PARAMETER LIST

Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range %	Prcsn % RPD	MDL µg/L	PQL µg/L
Benzene	5030	624	w	86 - 114	<20	0.5	1.0
Bromodichloromethane	5030	624	w	81 - 110	<15	0.5	1.0
Bromoform	5030	624	w	71 - 120	<15	0.5	1.0
Bromomethane	5030	624	w	0 - 242	<40	0.5	4.0
Carbontetrochloride	5030	624	w	76 - 107	<30	0.5	1.0
Chlorobenzene	5030	624	w	82 - 124	<20	0.5	1.0
Chloroethane	5030	624	w	37 - 243	<55	0.5	1.0
2-Chloroethylvinyl ether	5030	624	w	60 - 130	<30	0.5	1.0
Chloroform	5030	624	w	79 - 106	<30	0.5	1.0
Chloromethane	5030	624	w	0 - 110	<30	0.5	1.0
1,2-Dichlorobenzene	5030	624	w	79 - 116	<15	0.5	1.0
1,3-Dichlorobenzene	5030	624	w	86 - 112	<15	0.5	1.0
1,4-Dichlorobenzene	5030	624	w	80 - 109	<15	0.5	1.0
Dibromochlormethane	5030	624	w	84 - 117	<15	0.5	1.0
1,1-Dichloroethane	5030	624	w	81 - 117	<15	0.5	1.0
1,2-Dichloroethane	5030	624	w	82 - 116	<20	0.5	1.0
1,1-Dichloroethene	5030	624	w	67 - 130	<20	0.5	1.0
Cis-1,2-Dichloroethene	5030	624	w	65 - 129	<30	0.5	1.0
Trans-1,2-Dichloroethene	5030	624	w	85 - 115	<20	0.5	1.0
1,2-Dichloropropane	5030	624	w	83 - 116	<20	0.5	1.0
Cis-1,3-Dichloropropene	5030	624	w	81 - 107	<20	0.5	1.0
Trans-1,3-Dichloropropene	5030	624	w	73 - 108	<15	0.5	1.0
Ethylbenzene	5030	624	w	89 - 118	<15	0.5	1.0
Methylene Chloride	5030	624	w	78 - 120	<15	0.5	1.0
1,1,2,2-Tetrachloroethane	5030	624	w	70 - 136	<20	0.5	1.0
Tetrachloroethene	5030	624	w	79 - 117	<30	0.5	1.0
1,1,1-Trichloroethane	5030	624	w	81 - 116	<30	0.5	1.0
1,1,2-Trichloroethane	5030	624	w	76 - 118	<7.0	0.5	1.0
Trichloroethene	5030	624	w	77 - 111	<20	0.5	1.0
Trichlorogluro-methane	5030	624	w	31 - 190	<40	0.5	1.0
Toluene	5030	624	w	80 - 116	<10	0.5	1.0
o-Chloro-Toluene	5030	624	w	93 - 109	<15	0.5	1.0
Vinyl Chloride	5030	624	w	28 - 130	<17	0.5	1.0
Xylenes	5030	624	w	85 - 120	<10	0.5	1.0
2-Butanone (MEK)	5030	624	w	80 - 120	<40	10	100
Acetone	5030	624	w	80 - 120	<40	10	100
Carbon Disulfide	5030	624	w	80 - 120	<40	1.0	5
4-Me-2-Pentanone	5030	624	w	80 - 120	<40	10	50
2-Hexanone	5030	624	w	80 - 120	<40	10	50
Styrene	5030	624	w	80 - 120	<40	10	50

Matrices are denoted as follows:

w: ground water
s: soil and sediment

RPD is the relative percent difference.

MDL is the Method Detection Limit, which is defined as the minimum concentration of an analyte that can be measured by the method with 99 percent confidence of its presence in the sample matrix.

PQL is the Practical Quantitation Limit, which is the lowest level of concentration that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions.

TABLE 6-2
(continued)

SAMPLING PARAMETER LISTS

GROUP D SAMPLING PARAMETER LIST

Analyte	Analysis Method	Matrix	Accuracy Range %	Prcsn % RPD	MDL µg/L	PQL µg/L
4-Chloro-3-Methylphenol	625	w	49 - 115	<42	0.8	4.0
2-Chlorophenol	625	w	40 - 112	<42	0.8	4.0
2,4-Dichlorophenol	625	w	67 - 131	<42	0.8	4.0
2,6-Dichlorophenol	625	w	48 - 139	<42	0.8	4.0
2,4-Dimethylphenol	625	w	21 - 63	<42	3.0	15
2,4-Dinitrophenol	625	w	68 - 141	<42	6.0	30
2-Methyl-4,6-Dinitrophenol	625	w	62 - 142	<42	3.0	15
2-Nitrophenol	625	w	78 - 140	<42	1.5	7.5
4-Nitrophenol	625	w	25 - 47	<42	3.0	15
Pentachlorophenol	625	w	1 - 157	<42	3.0	15
Phenol	625	w	32 - 112	<42	0.8	4.0
2,4,6-Trichlorophenol	625	w	59 - 123	<42	0.8	4.0
Acenaphthene	625	w	58 - 118	<42	0.8	4.0
Acenaphthylene	625	w	56 - 116	<42	0.8	4.0
Anthracene	625	w	77 - 113	<42	0.8	4.0
Azobenzene	625	w	66 - 110	<42	0.8	4.0
Benzo[a]anthracene	625	w	81 - 97	<42	0.8	4.0
Benzo[b]fluoranthene	625	w	62 - 98	<42	0.8	4.0
Benzo[k]fluoranthene	625	w	76 - 86	<42	0.8	4.0
Benzo[a]pyrene	625	w	72 - 92	<42	0.8	4.0
Benzo[g,h,i]perylene	625	w	70 - 102	<42	1.5	7.5
Benzl butyl phthalate	625	w	68 - 106	<42	0.8	4.0
Benzidine	625	w	34 - 120	<42	50	250
Bis(2-Chloroethyl)-Ether	625	w	43 - 63	<42	0.8	4.0
Bis(2-Chloroethoxy)-Methane	625	w	43 - 153	<42	0.8	4.0
Bis(2-Chloroispropyl)-Ether	625	w	57 - 89	<42	1.5	7.5
Bis(2-Ethylhexyl)-Phthalate	625	w	54 - 180	<42	2.5	13
4-Bromophenylphenyl	625	w	87 - 133	<42	0.8	4.0
Chrysene	625	w	79 - 95	<42	0.8	4.0
2-Chloronaphthalene	625	w	28 - 100	<42	0.8	4.0
4-Chlorophenylphenyl Ether	625	w	71 - 143	<42	0.8	4.0
Dibenza[a,h]anthracene	625	w	69 - 99	<42	1.5	7.5
1,2-Dichlorobenzene	625	w	55 - 127	<42	1.5	7.5
1,3-Dichlorobenzene	625	w	52 - 118	<42	1.5	7.5
1,4-Dichlorobenzene	625	w	12 - 108	<42	1.5	7.5
3,3'-Dichlorobenzidine	625	w	52 - 130	<42	1.5	7.5
Diethylphthalate	625	w	65 - 135	<42	2.5	13
Dimethylphthalate	625	w	10 - 130	<42	0.8	4.0
Di-n-butyl phthlate	625	w	72 - 141	<42	0.8	4.0
2,4-Dinitrotoluene	625	w	40 - 121	<42	1.5	7.5
2,6-Dinitrotoluene	625	w	55 - 141	<42	1.5	7.5
Fluoranthene	625	w	79 - 121	<42	0.8	4.0
Fluorene	625	w	68 - 126	<42	0.8	4.0
Hexachlorobenzene	625	w	92 - 132	<42	0.8	4.0

TABLE 6-2
(continued)

SAMPLING PARAMETER LISTS

GROUP D SAMPLING PARAMETER LIST

Analyte	Analysis Method	Matrix	Accuracy Range %	Prcsn % RPD	MDL µg/L	PQL µg/L
Hexachlorobutadiene	625	w	39 - 105	<42	3.0	15
Hexachloro-Cyclopentadiene	625	w	25 - 111	<42	12	60
Hexachloroethane	625	w	54 - 126	<42	3.0	15
Indeno[1,2,3-c,d]pyrene	625	w	56 - 102	<42	1.5	7.5
Isophorone	625	w	56 - 120	<42	0.8	4.0
Naphthalene	625	w	42 - 133	<42	0.8	4.0
Nitrobenzene	625	w	52 - 196	<42	0.8	4.0
N-nitrosodimethylamine	625	w	45 - 126	<42	1.5	7.5
N-nitrosodi-n-Propylamine	625	w	41 - 131	<42	0.8	4.0
N-nitrosodiphenylamine	625	w	31 - 120	<42	0.8	4.0
Phenanthrene	625	w	65 - 128	<42	0.8	4.0
Pyrene	625	w	66 - 124	<42	0.8	4.0
1,2,4-Trichlorobenzene	625	w	12 - 132	<42	0.8	4.0
Acetophenone	625	w	35 - 131	<42	0.8	4.0
2-Acetylamino-Fluorene	625	w	58 - 128	<42	1.5	7.5
Aldrin	625	w	15 - 120	<42	0.8	4.0
4-Aminobiphenyl	625	w	31 - 146	<42	0.8	4.0
Aniline	625	w	25 - 120	<42	0.8	4.0
Alpha-BHC	625	w	33 - 119	<42	1.5	7.5
Beta-BHC	625	w	36 - 131	<42	1.5	7.5
Ganna-BHC	625	w	41 - 131	<42	1.5	7.5
Delta-BHC	625	w	23 - 141	<42	3.0	15
Benzylalcohol	625	w	20 - 140	<42	1.5	7.5
4-Chloroaniline	625	w	31 - 142	<42	0.8	4.0
4,4'-DDD	625	w	D - 130	<42	0.8	4.0
4,4'-DDE	625	w	23 - 133	<42	0.8	4.0
4,4'-DDT	625	w	D - 125	<42	1.5	7.5
Dibenzofuran	625	w	19 - 108	<42	0.8	4.0
Dieldrin	625	w	38 - 127	<42	1.5	7.5
Dimethylaminoazobenzene	625	w	18 - 109	<42	0.8	4.0
7,12-Dimethylbenz(A)anthracene	625	w	42 - 120	<42	0.8	4.0
1,3-Dinitrobenzene	625	w	35 - 116	<42	1.5	7.5
Dinoseb	625	w	28 - 138	<42	12	60
Diphenylamine	625	w	15 - 135	<42	0.8	4.0
Endosulfan I	625	w	D - 118	<42	12	60
Endosulfan II	625	w	D - 118	<42	12	60
Endosulfan Sulfate	625	w	D - 103	<42	3.0	15
Endrin	625	w	D - 133	<42	6.0	30
Endrin Aldehyde	625	w	D - 141	<42	6.0	30
Ethyl Methanesulfonate	625	w	36 - 141	<42	0.8	4.0
Hexachloropropene	625	w	15 - 120	<42	6.0	30
Isosafrole	625	w	40 - 132	<42	0.8	4.0
Methapryilene	625	w	D - 140	<42	3.0	15
3-Methylcholanthrene	625	w	40 - 120	<42	1.5	7.5

TABLE 6-2
(continued)

SAMPLING PARAMETER LISTS

GROUP D SAMPLING PARAMETER LIST

Analyte	Analysis Method	Matrix	Accuracy Range %	Prcsn % RPD	MDL µg/L	PQL µg/L
Methyl Methanesulfonate	625	w	40 - 120	<42	0.8	4.0
2-Methylnaphthalene	625	w	22 - 160	<42	0.8	4.0
1,4-Napthaquinone	625	w	21 - 136	<42	100	500
1-Naphthylamine	625	w	32 - 120	<42	0.8	4.0
2-Nitroaniline	625	w	D - 138	<42	1.5	7.5
3-Nitroaniline	625	w	D - 138	<42	1.5	7.5
4-Nitroaniline	625	w	D - 138	<42	1.5	7.5
5-Nitro-o-toluidine	625	w	10 - 114	<42	1.5	7.5
4-Nitroquinoline-1-oxide	625	w	D - 127	<42	12	60
N-Nitrosodiethylamine	625	w	16 - 149	<42	0.8	4.0
N-Nitrosomethylethylamine	625	w	10 - 146	<42	1.5	7.5
N-Nitrosopiperidine	625	w	28 - 116	<42	0.8	4.0
N-Nitrosopyrrolidine	625	w	26 - 132	<42	0.8	4.0
PCB-1016	625	w	19 - 121	<42	300	1500
PCB-1221	625	w	19 - 121	<42	300	1500
PCB-1232	625	w	19 - 121	<42	300	1500
PCB-1242	625	w	19 - 121	<42	300	1500
PCB-1254	625	w	19 - 121	<42	300	1500
PCB-1260	625	w	19 - 121	<42	300	1500
PCB-1262	625	w	19 - 121	<42	300	1500
Pentachlorobenzene	625	w	42 - 119	<42	0.8	4.0
Pentachloroethane	625	w	29 - 112	<42	100	500
Pentachloronitrobenzene	625	w	15 - 136	<42	3.0	15
Phenacetin	625	w	29 - 121	<42	0.8	4.0
2-Picoline	625	w	32 - 128	<42	0.8	4.0
Pyridine	625	w	44 - 130	<42	0.8	4.0
Safrole	625	w	D - 116	<42	3.0	15
1,2,4,5-Tetrachlorobenzene	625	w	42 - 132	<42	0.8	4.0
o-Toluidine	625	w	32 - 146	<42	0.8	4.0
2,4,5-Trichlorophenol	625	w	41 - 128	<42	0.8	4.0
1,3,5-Trinitrobenzene	625	w	28 - 136	<42	12	60
Toxaphene	625	w	14 - 142	<42	500	2500
m,p-Cresol	625	w	25 - 132	<42	0.8	4.0
o-Cresol	625	w	21 - 127	<42	0.8	4.0
Carbazole	625	w	35 - 140	<42	1.5	7.5
3,3'Dimethyl Benzidine	625	w	34 - 120	<42	50	250
Heptachlor	625	w	D - 172	<42	1.5	7.5
Heptachlor Epoxide	625	w	71 - 110	<42	1.5	7.5
2-Naphthylamine	625	w	32 - 120	<42	0.8	4.0
N-Nitrosodi-n-butylamine	625	w	13 - 198	<42	0.8	4.0
2,3,4,6-Tetrachlorophenol	625	w	48 - 128	<42	1.5	7.5

Matrices are denoted as follows:

- w: ground water
- s: soil and sediment

RPD is the relative percent difference.

MDL is the Method Detection Limit, which is defined as the minimum concentration of an analyte that can be measured by the method with 99 percent confidence of its presence in the sample matrix.

PQL is the Practical Quantitation Limit, which is the lowest level of concentration that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions.

D in the Accuracy Range denotes use of a "detection" as the lower limit on accuracy.

TABLE 6-2
(continued)

SAMPLING PARAMETER LISTS

GROUP E SAMPLING PARAMETER LIST

Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range %	Prcsn % RPD	MDL µg/L	PQL µg/L
Aldrin	3550	8080	s	55 - 111	<35	0.47	1.7
Benfluralin	3550	8080	s	45 - 120	<50	0.70	3.3
Alpha-BHC	3550	8080	s	50 - 94	<60	0.4	1.7
Beta-BHC	3550	8080	s	61 - 125	<30	0.7	3.3
Delta-BHC	3550	8080	s	42 - 114	<47	0.4	1.7
Gamma-BHC	3550	8080	s	54 - 106	<50	0.4	1.7
Chlordane Technical	3550	8080	s	45 - 119	<50	5	33
Gamma Chlordane	3550	8080	s	45 - 120	<50	0.40	1.7
Alpha Chlordane	3550	8080	s	45 - 120	<50	0.40	1.7
p,p'-DDD	3550	8080	s	58 - 130	<30	0.7	3.3
p,p'-DDE	3550	8080	s	58 - 130	<50	0.7	3.3
p,p'-DDT	3550	8080	s	74 - 134	<30	0.7	3.3
Dieldrin	3550	8080	s	65 - 125	<30	0.7	1.7
Endosulfan I	3550	8080	s	65 - 121	<30	0.4	3.3
Endosulfan II	3550	8080	s	68 - 132	<30	0.4	3.3
Endosulfan Sulfate	3550	8080	s	60 - 124	<30	0.7	3.3
Endrin	3550	8080	s	30 - 147	<50	0.7	3.3
Endrin Ketone	3550	8080	s	45 - 120	<50	0.70	3.3
Endrin Aldehyde	3550	8080	s	16 -144	<50	0.7	3.3
Heptaclor	3550	8080	s	51 - 127	<40	0.4	1.7
Heptachlor Epoxide	3550	8080	s	78 - 112	<40	0.4	3.3
Methoxychlor	3550	8080	s	82 - 122	<30	1.7	13.3
Mirex	3550	8080	s	45 - 120	<50	0.70	3.3
Oxadiazon	3550	8080	s	45 - 120	<50	0.70	3.3
PCNB	3550	8080	s	50 - 100	<50	1.7	3.3
Toxaphene	3550	8080	s	41 - 126	<50	17	33
PCB 1016	3550	8080	s	50 - 120	<50	7	33
PCB 1221	3550	8080	s	15 - 178	<50	7	33
PCB 1232	3550	8080	s	60 - 110	<50	7	33
PCB 1242	550	8080	s	60 - 120	<50	7	33
PCB 1248	3550	8080	s	60 - 110	<50	7	33
PCB 1254	3550	8080	s	60 - 110	<50	7	33
PCB 1260	3550	8080	s	50 - 110	<50	7	33
Carbophenothion	3550	8080	s	50 - 130	<50	1.0	6.6
Chlorothalonil	3550	8080	s	50 - 110	<50	0.7	6.6
Dicofol	3550	8080	s	50 - 120	<50	0.7	13
Pendimetalin	3550	8080	s	50 - 120	<50	1.7	6.6
Trifluralin	3550	8080	s	40 - 120	<50	0.7	3.34
Cypermethrin	3550	8080	s	50 - 125	<50	1.7	7
Permethrin	3550	8080	s	50 - 125	<50	1.7	7

Matrices are denoted as follows:

w: ground water
s: soil and sediment

RPD is the relative percent difference.

MDL is the Method Detection Limit, which is defined as the minimum concentration of an analyte that can be measured by the method with 99 percent confidence of its presence in the sample matrix.

PQL is the Practical Quantitation Limit, which is the lowest level of concentration that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions.

TABLE 6-2
(continued)

SAMPLING PARAMETER LISTS

GROUP F SAMPLING PARAMETER LIST

Analyte	Prep Method	Analysis Method	Matrix	Accuracy Range %	Prcsn % RPD	MDL µg/L	PQL µg/L
Iron	3005, 3015	200.7	w	80 - 120	<20	3	10
Turbidity	n/a	180.1	w	80 - 120	<20	0.5NTU	0.5NTU

Matrices are denoted as follows:

w: ground water
s: soil and sediment

RPD is the relative percent difference.

MDL is the Method Detection Limit, which is defined as the minimum concentration of an analyte that can be measured by the method with 99 percent confidence of its presence in the sample matrix.

PQL is the Practical Quantitation Limit, which is the lowest level of concentration that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions.

TABLE 6-3

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (WATER SAMPLES)

PARAMETER	CONTAINER(1)	PRESERVATION(2,3)	MAX HOLD TIME(4)
Inorganic Tests:			
Organic carbon	P, G	Cool, 4°C, HCl or H_2SO_4, to pH < 2	28 days
Residue, total	P, G	Cool, 4°C	7 days
Residue, filterable	P, G	Cool, 4°C	7 days
Residue, Nonfilterable	P, G	Cool, 4°C	7 days
Turbidity	P, G	Cool, 4°C	48 hours
Organic Tests: (note 5)			
Pesticides	G, Teflon-lined cap	Cool 4°C, store in dark	7 days until extraction, 40 days after extraction
Base/Neutral/Acid Extractables	G, Teflon-lined cap	Cool, 4°C, store in dark	7 days until extraction, 40 days after extraction
VOCs	G, Teflon-	Cool, 4°C	7 days
	lined septum	Cool, 4°C, HCl to pH < 2 (note 6)	14 days
Metals:			
Fe	P, G	HNO_3 to pH < 2	6 months

NOTES:

1. Polyethylene (P) or Glass (G).
2. Sample preservation should be performed immediately upon sample collection.
3. When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCL) in water solutions at concentrations of 0.04 percent by weight or less (pH about 1.96 or greater); Nitric acid (HN03) in water solutions at concentrations 0.15 percent by weight or less (pH about 1.62 or greater); Sulfuric acid (H2S04) in water solutions at concentrations of 0.35 percent by weight or less (pH about 1.15 or greater); and Sodium hydroxide (Na0H) in solutions at concentrations of 0.080 percent by weight or less (pH about 12.30 or less).
4. Samples should be analyzed as soon as possible after collection. The time listed are the maximum times that samples may be held before analysis and still be considered valid.
5. Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
6. Sample receiving no pH adjustment must be analyzed within seven days of sampling.

TABLE 6-4

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, HOLDING TIMES AND SAMPLE SIZE (SOIL SAMPLES)

PARAMETER GROUP	PRESERVATION	CONTAINER	MAX HOLD TIME
VOCs	(2)	Glass, 40 ml vial or 4 oz widemouth with Teflon and silicone septum (50 grams sample)	14 days until extraction, 40 days after extraction.
Base/Neutral/Acid Extractables	(2)	Glass, 8 oz. widemouth with Teflon-lined cap (50 grams sample)	14 days until extraction, 40 days after extraction.
Pesticides	(2)	Glass, 8 oz. widemouth with Teflon-lined cap (50 grams sample)	14 days until extraction, 40 days after extraction.
Sieve Analysis	n/a	Glass or plastic, 16 oz. widemouth (1,000 gram sample)	n/a
Falling Head Permeameter	n/a	Glass or plastic, 16 oz. widemouth (1,000 gram sample)	n/a

NOTES:

(1). VOC sample shall not be homogenized (mixed) prior to filling container. Container must be filled by packing as much sample into it leaving minimal headspace. Field samples cannot be composited for analysis.

(2). Soils and sediments shall be kept cool at 4C from collection time until analysis.

6.5.3.1 Sampling with Pumps

With the exception of the dedicated pumps in the Corry Station public supply wells, pumps shall not be used to collect samples. Sampling of public supply wells is discussed in **Section 6.5.2.3 -- Sampling Wells with In-Place Plumbing**

6.5.3.2 Sampling with Bailers

The following procedures describe general bailing techniques. Field personnel shall wear disposable gloves during all phases of bailer handling and sample collection. Gloves shall be replaced regularly during purging and sampling activities, particularly between cessation of purging and commencement of sampling. Bailer lanyards may be disposable (braided or monofilament nylon or reusable (stainless steel or teflon-coated). Disposable lanyards shall be replaced between monitor wells. Reusable lanyards must be decontaminated between monitor wells according to **Section 6.3.17 -- In-field Cleaning of Reusable Bailer Lanyards.** Bailer lanyards shall be handled so as not touch to anything except the sampler's hands and the well casing. All lanyards must be securely fastened to the bailer.

Lower the bailer slowly and gently into contact with the water so that agitation of the water column is minimized. Prior to sample collection, and immediately after purging, 5 bailer volumes shall be removed and discarded. Attempt to sample from the same depth in the well each time, preferably just below the water surface. Do not allow the bailer to touch the bottom of the well so that bottom sediments are not incorporated into the sample. Retrieve the bailer smoothly.

The sample collection sequence is as follows:

a. Volatile Organic Contaminants (VOCs)
b. Extractable Organics [includes pesticides]
c. Metals
d. Organic Carbon, Inorganics and Physical Properties

Volatile Organic Compound Sampling (USEPA Method #624)

Volatile organic compounds (VOCs) are among the most difficult compounds to sample. Because these volatilize at low temperatures, they will readily escape from ground water samples. But because they are ubiquitous chemical compounds, they are also readily added to a sample. To effectively sample for VOCs, the collection process must be clean, gentle, and rapid. The VOC sample shall be collected immediately after purging the well. To minimize the possibility of cross-contamination, empty VOC vials will be transported to the field in new, unused paint cans. Filled VOC vials will be transported to the laboratory in paint cans packed with vermiculite.

1. Be sure all gas-powered equipment is located downwind of the well.

2. Wearing new unpowdered latex gloves, remove the VOC vials from the paint can. Examine each for any obvious defects or contaminants. Discard any vials which appear flawed. Document disposal in field notebook.

3. Add 5 drops of 1:1 hydrochloric acid (supplied by laboratory) to each vial, placing the Teflon-coated lid on top of the vial afterwards. Add 5 drops of acid to a fourth pH test vial also. NOTE: Vials for VOCs are not rinsed with sample. Safety glasses shall be worn during addition of acid to vials.

4. Unwrap the foil from the pre-cleaned bailer and firmly attach a bailer line to the bailer top.

5. Gently lower the bailer into the top of the water column, allow it to fill completely, and retrieve, carefully handling the bailer lines. Discard the bailer contents and repeat for 5 bailer volumes.

6. After acclimating the bailer to the sample matrix, fill the bailer again and attach a control-flow bottom to the bailer.

7. Fill the pH test vial to the rim with sample. Screw the lid on and invert the vial 2-3 times to mix the preservative and the sample. Quickly check the test sample with pH paper to verify that the pH is between 1 and 2. If the pH of the test sample is greater than 2, do not add more acid to the sample vials. Instead, state in the comment section of the field custody sheet that the VOC sample has a pH greater than 2. This will alert the laboratory to analyze the sample within 7 days of receipt. This rarely should occur.

8. Discard the pH test sample and vial and allow approximately 100 ml of sample to flow through the bailer bottom, adjusting the flow until it is a slow steady stream.

9. Now fill the first sample vial, allowing the sample stream to flow down the side of the vial, being careful to avoid contact between the bailer and the sample container. When the sample nears the top of the vial, slow the stream to a minimum, fill to the rim, leaving a positive meniscus on the vial top, without losing the preservative. Once filled, cap the vial and invert, tap the capped end with hand, and inspect the sample for any bubbles. If air bubbles are present in the vial, uncap it and attempt to top it off with samples from the bailer. After 2 attempts to eliminate air from the vial, discard the vial, and begin again.

10. Fill remaining vials. Place the vials in the ziplock bag. Fill out a label (if one has not previously been prepared), and place the label on the outside of the ziplock bag. Place the ziplock bag in the paint can, and fill the can with

vermiculite. Vermiculite can be obtained from any garden store and due to its sorptive qualities, it is an excellent safeguard against cross-contamination. Now hammer the lid onto the can, so that a screwdriver will be needed to pry it open.

11. Fill out a label (if one has not previously been prepared), and place the label on the outside of the can.

12. Place the can in its cooler with plenty of ice. A trip blank should also be in the cooler.

Base/Neutral/Acid Extractable (USEPA Method #625) and Pesticide (USEPA Method #608) Sampling (unfiltered and unpreserved)

Collecting the base/neutral extractable and pesticide samples is not as tricky as for VOCs. However, do not allow the samples to remain in sunlight any longer than is absolutely necessary.

1. Wear new unpowdered latex gloves.

2. Examine sample bottle(s) and their caps for flaws. Discard if necessary. Document disposal in field notebook.

3. Rinse bottles with 20-30 milliliters of sample from the bailer. Discard rinse.

4. Fill bottle(s) with sample to within a half inch of the top. It is not necessary to use the control flow bottom but every effort should be made to prevent contact between the bailer and the sample container.

5. Place a label on each bottle.

6. Place the bottle(s) in the cooler with plenty of ice.

Residue and Turbidity (unfiltered and unpreserved)

These constituents shall be collected in the manner used to collect the Base/Neutral/Acid Extractable and Pesticide samples. Sample bottles shall be as per Table 6-3.

Organic Carbon (unfiltered and filtered, and field preserved)

In order to determine both total and dissolved organic carbon it will be necessary to filter these samples in the field. Both samples are preserved.

1. Wear new unpowdered latex gloves.

2. Examine sample bottle(s) and their caps for flaws. Discard if necessary. Document disposal in field notebook.

3. Rinse bottle with 20-30 ml of sample. It is not necessary to rinse these containers with sample, if containers are acid-rinsed in the laboratory.

4. Fill each of the containers labeled for unfiltered samples from the bailer. Fill bottle(s) with sample to within a half-inch of the top. When adding preservatives in the field, the sample container should not be filled to capacity.

NOTE: If containers are pre-preserved by a subcontract laboratory, there is no rinse of the bottle and the sample must be poured into the container slowly to prevent acid from splattering. As a precautionary note, the addition of water to acid can generate enough heat to burn unprotected hands.

5. Cap and set the unfiltered samples aside or in a separate container.

6. Refill the bailer. Check flow direction arrow on the disposable filter unit and attach to the filled bailer accordingly.

7. Using a hand pump to pressurize the bailer, pump about 500 ml of sample to rinse filter.

8. Rinse bottle with 20-30 ml of <u>filtered</u> sample. It is not necessary to rinse these containers with sample, if containers are acid-rinsed in the laboratory.

9. Fill containers for filtered samples to within one half-inch of top and cap.

10. Set these bottles in filtered group of samples.

11. Add ampule(s) of acid to each unfiltered and filtered sample, in one-ampule increments, until pH of each sample is below 2. Document amount of acid added.

12. Tightly cap the sample container and shake to distribute the acid. Pour a small volume (less than 5 ml) of the acidified sample into a disposable container (e.g. sampling cup) or onto a piece of NARROW range pH paper to determine if the pH is less than 2 standard units. **DO NOT PUT THE pH PAPER DIRECTLY INTO THE SAMPLE CONTAINER!**

NOTE: If the pH is greater than 2, add additional MEASURED amounts of acid until the pH has been reduced. Record the total amount of acid that was added. This documentation is necessary, since additional acid may need to be added to

the sample on subsequent visits. Acidify at least one of the equipment blank(s) with the GREATEST amount of acid that was required in the sample set and note the amount in field documentation.

13. Following proper sample preservation, tightly cap, add any additional information to sample label, label sample and complete the sample transmittal form.

14. Place the bottle(s) in the cooler with plenty of ice.

Fe (unfiltered and field preserved)

1. Wear new unpowdered latex gloves.

2. Examine sample bottle(s) and their caps for flaws. Discard if necessary. Document disposal in field notebook.

3. Rinse bottle with 20-30 ml of sample. It is not necessary to rinse these containers with sample, if containers are acid-rinsed in the laboratory.

4. Fill each of the container(s) from the bailer. Fill bottle(s) with sample to within a half-inch of the top. When adding preservatives in the field, the sample container should not be filled to capacity.

NOTE: If containers are pre-preserved by a subcontract laboratory, there is no rinse of the bottle and the sample must be poured into the container slowly to prevent acid from splattering. As a precautionary note, the addition of water to acid can generate enough heat to burn unprotected hands.

5. Add ampule(s) of acid to sample, in one-ampule increments, until pH of each sample is below 2. Document amount of acid added.

6. Tightly cap the sample container and shake to distribute the acid. Pour a small volume (less than 5 ml) of the acidified sample into a disposable container (e.g. sampling cup) or onto a piece of NARROW range pH paper to determine if the pH is less than 2 standard units. **DO NOT PUT THE pH PAPER DIRECTLY INTO THE SAMPLE CONTAINER!**

NOTE: If the pH is greater than 2, add additional MEASURED amounts of acid until the pH has been reduced. Record the total amount of acid that was added. This documentation is necessary, since additional acid may need to be added to the sample on subsequent visits. Acidify at least one of the equipment blank(s) with the GREATEST amount of acid that was required in the sample set and note the amount in field documentation.

7. Following proper sample preservation, tightly cap, add any additional information to sample label, label sample and complete the sample transmittal form.

8. Place the bottle(s) in the cooler with plenty of ice.

6.5.3.3 Sampling Wells with In-Place Plumbing

Purging -- Purging criteria presented in **Section 6.5.1.3 -- Purging Criteria** shall be used to determine the required purge times for public supply wells. If it can be determined that a pump has run in excess of the length of time required to meet the criteria of **Section 6.5.1.3**, no additional purging is required, other than purging the sample collection spigot by opening the valve and allowing it to flush at maximum velocity for at least 5 min. Purge volume and time calculations shall be documented in the field notebook.

If is necessary to calculate the required purge volume (in the case when a pump is not running upon arrival for sampling), the purge volume determination criteria of **Section 6.5.1.2 -- Water Level and Purge Volume Determination** shall be used. If it is not possible to determine the depth to water, a depth of 0.0 ft shall be assumed. The pump shall run continuously until the required volume has been purged. Concurrently, the sample collection spigot shall be purged at maximum velocity for at least 5 min. Purge volume and time calculations, as well as purge beginning and ending times shall be documented in the field notebook.

Sampling -- Samples shall be collected in a manner generally similar to that used for bailers and as described above. All samples shall be collected from the spigot closest to the wellhead. In no case shall a sample be collected downgradient from any storage tank, filter, or GAC unit. All samples shall be collected from the previously-purged sample collection spigot. Prior to sample collection the spigot flow rate shall be reduced to 500 milliliters per minute, or less (50 milliliters or less per minute for VOCs). Sample bottles shall not be allowed to touch the spigot. Samples shall be collected in such a manner as to minimize sample aeration. Samples shall be collected in the order specified in **Section 6.5.2.2 -- Sampling with Bailers**.

6.6 Soil Sampling

Shallow soil samples and deep soil samples will be collected. Soil sampling will utilize different methodologies depending on the depth of sample being collected. All soil samples will be collected by the site geologist or qualified field technician. Soil lithologies will be characterized and recorded in the field notebook by the site geologist pursuant to **Work Plan Section 8.8 -- Field Geologic Logging**. Organic vapor (headspace) analysis will be performed on each sample collected.

Soil sample locations (both horizontal and vertical), and physical/chemical analysis to be performed are specified in **Work Plan Section 9.0 -- Site-Specific Assessments -- Phase II** and **Work Plan Section 10.0 -- Ground Water Flow and Contaminant Transport Model -- Phase III**. The organic vapor headspace survey will be completed as described in **Work Plan Section 8.4 -- Soil Headspace Survey** and in **Section 6.1.1 -- Organic Vapor Meters and Field Screening for Organics**.

6.6.1 Shallow Soil Sampling

Shallow soil samples, to a depth of approximately 5 ft, will be collected utilizing trowels, soil sampling probes and hand augers. Stainless steel and Teflon implements will be used. Both composite and non-composite samples may be collected.

6.6.2 Deep Soil Sampling

Soil sampling at depths greater than 5 ft will be performed utilizing a 2-in by 24 inch split spoon sampler. Standard penetration rates shall be recorded in accordance with ASTM D-1586. When samples collected are to be analyzed only for physical parameters, carbon steel split spoons can be utilized. If chemical analysis is scheduled, stainless steel split spoons or carbon steel split spoons with a Teflon insert will be used.

6.6.3 Sample Containers, Preservation and Holding Times

Required soil sample containers for different parameters are listed in Table 6-4. All samples shall be preserved according to the requirements specified in Table 6-4. Holding times to be observed are also included in Table 6-4. For those samples requiring it, samples shall be preserved immediately upon collection. USEPA has defined "immediate" as "within 15 min of sample collection". This definition shall apply to all sample preservation.

6.6.4 Soil Sample Collection Procedures

This discussion of soil sampling techniques will outline the use of handheld equipment and drilling equipment. The alternative devices for sampling different matrices, required construction materials for different parameter groups, and restrictions and precautions to be observed during sample collection are listed in Table 6-1. Sampling equipment shall be selected based on the type of sample to be collected and the parameters of interest.

All sampling equipment must be cleaned and decontaminated after each sample is collected. If composite samples are required, equipment need only be cleaned and decontaminated after all sample aliquots, combined for one composite, have been sampled. Cleaning and decontamination of sampling equipment is discussed in **Section 6.3 -- Decontamination/Cleaning Procedures for Sampling Equipment**. Cleaning and decontamination of drilling equipment is discussed in **Section 7.2** -- Drilling Equipment Decontamination and Cleaning. If only physical parameters are to be analyzed, decontamination will be in accordance with downhole drilling equipment, as described in **Section 7.2**. It is recommended that the same sampling crew perform all sampling, to minimize personnel handling variation. Field activities shall be documented in accordance with **Section 8.2 -- General Requirements for Custody and Documentation and Section 8.4 -- Custody and Documentation Requirements for Field Operations**.

Remove and discard portions of the sample that may have become contaminated from contact with the casing, auger, or drilling fluid. Samples are collected immediately after the boring is advanced to the desired sampling depth. The drilling contractor is not allowed to use oil, grease, or other petroleum-based lubricants on the drill rods, casing, or sampling tools. The drilling technique and procedures to be used, particularly the use of drilling fluids, are to be carefully evaluated at each site.

Drilling logs will be kept when drilling or boring. Detailed notes will be kept on each sample including location, volume, time, depth, and analysis. Weather conditions will be noted. Other field activities will be documented such as cleaning of tools. Standardized forms will be used when logging site lithology, soil samples, or pit/trench excavations.

In some cases, subsurface soils will be composited in order to characterize certain depth intervals. Several aliquots consisting of equal volumes of soil material will be collected from a number of segments within the sample interval and homogenized as a composite sample. Each composite sample will consist of a predetermined number of aliquots. The soil aliquots will consist of equal volumes. Sample collection and homogenization will be conducted with stainless steel spoons, trowels, and mixing bowls. Decontamination of sampling implements will be conducted

before the collection of each composite sample, but will not be required between the collection of individual aliquots.

The sample collection sequence is as follows:

a. Volatile Organic Contaminants (VOCs)
b. Extractable Organics [includes pesticides]
c. Metals
d. Organic Carbon, Inorganics and Physical Properties

6.6.4.1 Shallow Soil Sample Acquisition

1. Select the appropriate precleaned sampling device (stainless steel bucket auger, stainless steel soil sampling probe, etc.). See Table 6-1 for specifics on sampling devices. Select the required sample container(s) for the parameter group(s) of interest. Examine each for any obvious defects or contaminants. Discard any vials which appear flawed. Use new, disposable, unpowdered latex gloves during all phases of sample collection.

2. Remove leaves, grass and surface debris from the area to be sampled using a clean stainless steel spoon, trowel or shovel.

3. Advance sampling device to the desired sample collection depth. A soil sample is obtained by pushing and rotating the auger into the soil until the bucket is filled.

4. Remove the sample from the sampling device with appropriate (stainless steel, Teflon) tools and place in a stainless steel, glass or aluminum foil-lined tray. Remove any portion of the sample that has been disturbed and discard. For VOC sampling, if possible, sample should be transferred directly from sampling device to sample container.

5. Carefully fill container with sample, using appropriate tools. Tamp the sample into the vial with a stainless steel, glass, or Teflon rod to reduce headspace. Add sample and tamp down until no headspace exists.

6. Wearing a new pair of disposable gloves, clean the outside of the sample container to remove excess soil.

7. The container rim should also be cleaned of soil and sand particles so that the lid can be sealed. An improperly sealed container may allow cross contamination.

8. Affix sample label to container. Place the sample container in a clean, plastic ziplock bag and preserve by placing on wet ice. Complete the sample transmittal forms.

6.6.4.2 Sample Compositing

Under no circumstances shall a sample for VOC analysis be taken from a composited sample. If VOCs are required from a sample that will yield samples for other parameters, collect the VOC sample first, preferably directly from the sampling device. The remainder of the sample may then be composited.

1. Complete Steps 1 through 4 of **Section 6.6.4.1** to obtain sample(s) for compositing.

2. Sample aliquots (of identical size) to be composited shall be placed in a tray of suitable materials and thoroughly mixed with a cleaned spoon, spoonula or spatula of suitable materials (see Table 6.1). The sample shall be thoroughly blended by mixing, and dividing into sections. Each section shall then be mixed separately. Recombine all mixed sections and mix thoroughly. Repeat sectioning and mixing process to ensure proper homogenization.

3. The origin, size, and depth of each subsample or aliquot that is used to make the composite shall be documented in the field notebook along with the other important sampling details. It is critical that these subsamples be of equivalent size, so that the composite sample is not biased by unequal aliquoting. Aliquoting should be done in a systematic manner.

4. Complete sample collection process as per Steps 5 through 8 of **Section 6.6.4.1** above.

6.6.4.3 Deep Soil Sample Acquisition

Split Spoon Sampler -- A split spoon sampler, useful for sampling unconsolidated soils, consists of two stainless (or carbon steel) half cylinders (spoons) that fit together to form a tube approximately 2 ft in length and 2 in in diameter. The cylindrical arrangement is maintained by a retaining head and bit rings that screw on at either end of the split spoon. The bit ring has beveled edges to facilitate sampling as the split spoon is forced into the ground. A mechanical hammer is used to advance the sampler. A catcher device is inserted in the head ring to prevent loss of unconsolidated sample during recovery.

1. Select the appropriate precleaned sampling device (stainless steel split spoon, carbon steel split spoon). See Table 6-1 for specifics on sampling devices. Select the required sample container(s) for the parameter group(s) of interest. Examine each for any obvious defects or contaminants. Discard any vials which appear flawed. Use new, disposable, unpowdered latex gloves during all phases of sample collection.

2. Advance borehole to the desired sample collection depth using mechanical drilling equipment. Using drilling rig hammer, advance split spoon into undisturbed formation. Retrieve split spoon.

3. Breakdown the split spoon with the appropriate tools. This is done by unscrewing the bit and head rings and splitting the barrel.

4. Dispose of any disturbed sample (generally the top 2 to 3 in of the sample) by removing it with a stainless steel spatula and discarding it.

5. Slice the sample using a clean, decontaminated stainless steel spatula from the center portion of the split spoon. For VOC analyses, immediately transfer the sliced portion to a suitable container (the container must be equipped with a teflon-lined septum seal).

6. For other analyses, slice sufficient amount of sample from the center portion of the sampling device and transfer it to a tray of appropriate construction (note restrictions on use in Table 6-1).

7. Carefully fill container with sample, using appropriate tools. Tamp the sample into the vial with a stainless steel, glass, or Teflon rod to reduce headspace. Add sample and tamp down until no headspace exists.

8. Wearing a new pair of disposable gloves, clean the outside of the sample container to remove excess soil.

9. The container rim should also be cleaned of soil and sand particles so that the lid can be sealed. An improperly sealed container may allow cross contamination.

10. Affix sample label to container. Place the sample container in a clean, plastic ziplock bag and preserve by placing on wet ice. Complete the sample transmittal forms.

6.6.4.4 Teflon Liners

If properly used, Teflon liners may be inserted into the sampler and used as the actual sample container. SW-846 has mandated that all solid samples must be transported in containers that have screw tops, accordingly all SW-846-derived container and lid requirements are still in effect.

1. For inorganic samples, ends of the liner must be covered with polyethylene, Teflon, or aluminum foil sheeting. The sheeting should be secured by placing an end cap over the sheeting.

2. For organic samples, the sheeting must be Teflon or aluminum foil.

3. With any sample containerized this way, specific instructions must be sent with the sample so that the laboratory will know how to handle the sample. All non-volatile samples must be homogenized by the laboratory prior to analyses. Also, any disturbed portions of the sample should be discarded prior to mixing.

7.0 DRILLING AND MONITORING WELL INSTALLATION

7.1 Well Installation

Construction of water quality monitor wells, potentiometric surface monitor wells and a production well will be required. Wells will be installed utilizing both hollow-stem auger and hydraulic rotary methods. A qualified geologist will supervise all drilling operations, collect split spoon samples and formation cuttings, and maintain a detailed lithology (**Work Plan Section 8.8 -- Field Geologic Logging**) and drilling log. All wells constructed will be fully grouted utilizing a cement-bentonite grout consisting of 94 lbs of cement to 5 lbs to bentonite to 6.5 gal of potable water. The consistency will be approved by the on-site geologist prior to placement. All water utilized in the drilling process will be potable water obtained from the Corry Station public water supply system. A sample of the supply water will be collected during each mobilization involving well installation and analyzed for parameters of interest. Actual well locations and construction specifications are specified in **Work Plan Section 9.0 -- Site-Specific Assessments -- Phase II** and in **Work Plan Section 10.0 -- Ground Water Flow and Contaminant Transport Model -- Phase III**.

Detailed notes regarding well installation will be recorded in the field. The placement of filter pack and bentonite materials will be verified by tagging their position in the borehole during well construction, and recorded in the field notebook. Drilling conditions, such as drilling rate, OVA readings, formation caving, fluid loss, quantity of mud mixed, core recovery, and other pertinent information regarding the drilling process, conditions and well installation shall be recorded in the field notebook as applicable.

Drill cuttings generated during well construction shall not be moved off-site. Drill cuttings will be spread over a small area in the immediate vicinity of the well. The specific area where the cuttings were distributed will be noted and recorded in the field notes. The field geologist will determine if containment and analysis of the drill cuttings are warranted based on the guidelines provided by the U.S. Environmental Protection Agency, Office of Emergency and Remedial Response (OERR Directive 9345.3-02, Management of Investigation-Derived Wastes During Site Inspections, May 1991). The drill cuttings are not expected to pose an immediate threat to human health or the environment, and are not expected to degrade the condition of the site. If containment, chemical analysis and disposal of the drill cuttings are deemed necessary, a modification to the work plan will be required.

Monitor wells shall be constructed in general accordance with **Work Plan Appendix B -- Guidelines for Ground Water Monitoring Well Installation,** except for the deviations noted below and except as approved by the EIC. All monitor well construction will be performed by a qualified contractor. A qualified contractor must: 1) be licensed by the NWFWMD; 2) have experience working on similar projects (this will apply both to the individual drillers in the field and to the drilling company as a whole); 3) employ personnel who are OSHA-certified to work on hazardous waste sites; 4) have the necessary equipment capabilities; and 5) be approved by the Navy. All necessary well construction permits will be obtained by the contractor prior to well installation.

Subsequent to the completion of this project, all wells not needed for future monitoring shall be properly plugged in accordance with the requirements of Chapter 40-A3, Florida Administrative Code, Regulation of Wells. The actual wells selected for abandonment are dependent on the future monitoring needs of the Navy and can only be determined at the completion of this project. At that time provisions will be made to provide for plugging of all unneeded wells constructed as part of this investigation.

7.1.1 Ground Water Quality Monitor Wells

Ground water quality monitoring wells will be constructed by using hollow stem auger and hydraulic (mud) rotatory drilling methods. Monitoring wells will be completed in the shallow and deep zones of the Sand-and-Gravel Aquifer. All water quality monitoring wells will be completed with 4-in I.D., schedule 40 PVC casing and well screen. All well casings, screens, and end plugs will be flush-threaded. No solvent bonded joints will be allowed. Slotted pipe screen type will be used. Screen slot size is based on a multiplier of 3 times the 70 percent retained grain size (sieve analysis of core samples from Corry Station **Work Plan Section 7.4 -- Existing Data**). This provides for a U.S. standard sieve 20/30 filter pack and a conservatively selected screen slot size of 0.015 in. All screens will have an end plug to seal the open end and to act as a trap for sediment entering the well.

Water quality monitoring wells constructed to a depth less than 65 ft will be installed utilizing the hollow stem auger method with an inside diameter of 6.25 in or greater. Cuttings will be collected and described on 5 ft intervals and the depth to water table will be noted and recorded. Once the desired depth has been reached, the well screen and casing will be inserted inside of the hollow stem auger into the borehole. The augers will provide for centralization of the well screens. The filter pack (20/30 filter sand) will be installed around the well screen to approximately 2 ft or 10 percent of the screen length above the top of the screen while removing the hollow stem augers from the borehole. The formation will not be allowed to collapse around the well screen.

A 2-ft thick bentonite seal will be installed directly above the filter pack. If the bentonite seal is above the water table, potable water will be poured into the borehole to hydrate the bentonite. Time will be allowed, as per manufacturer recommendations, for hydration of the bentonite before grouting commences.

The remaining annular space will be filled, from bottom to top, with grout to a level of 3 ft below land surface. The grout will be pumped into the borehole with a tremie pipe. The remaining auger flights will be removed a section at a time during grouting. The grouting will be conducted continuously and in such a manner as to achieve filling the entire annular space. The formation will not be allowed to collapse around the well casing.

The 3 ft of annular space above the grout will be filled with 100 percent cement to land surface and a protective security cover will be set into the cement. Surface completion and well protection will be in general conformance with **Work Plan Appendix B -- Guidelines for Ground Water Monitoring Well Installation**.

Water quality monitor wells greater than approximately 65 ft will be installed utilizing the hydraulic rotary method with an 8 in nominal diameter borehole. Only self-contained, non-excavated mud pits and bentonite drilling muds will be used for this drilling method. The borehole will be flushed free of cuttings, and cuttings will be sampled and described each 10 ft.

Once the desired depth of the borehole is reached and the borehole stabilized, the drilling mud will be thinned and the borehole flushed of all remaining cuttings. After removal of the drill string, the screen and casing will be installed into the borehole. The screen and casing will be centralized using stainless steel centralizers spaced 30 to 40 ft along the length of the screen and casing. The filter pack (20/30 filter sand) will be installed around the well screen, utilizing a tremie pipe and potable water, to approximately 2 ft or 10 percent of the screen length above the top of the screen. A 2 ft cap of fine sand (30/40 filter sand) will then be installed directly on top of the filter pack to insure grout does not infiltrate the screened interval.

The remaining annular space will be filled with grout, to a level of 3 ft below land surface. The grout will be pumped into the borehole with a tremie pipe. The grouting will be conducted continuously and in such a manner as to achieve filling the entire annular space from just above the 30/40 filter sand cap to 3 ft below land surface. The 3 ft of annular space above the grout will be filled with 100 percent cement to land surface and a protective security cover will be set into the cement. Surface completion and well protection will be in general conformance with **Work Plan Appendix B -- Guidelines for Ground Water Monitoring Well Installation**.

7.1.2 Potentiometric Surface Monitor Wells

Potentiometric surface monitoring wells will be constructed using mud-rotary drilling methods. These wells will be used solely for determining water surface elevations and for sampling parameters appropriate to the construction methodology (turbidity and inorganic parameters, probably limited to Fe). Potentiometric surface monitoring wells will be completed in the shallow and deep zones of the Sand-and-Gravel Aquifer. All potentiometric surface monitoring wells will be completed with either 2-in or 4-in I.D., Schedule 40 PVC casing and well screen as specified in **Work Plan Section 10.0 -- Ground Water Flow and Contaminant Transport Model**. All well casings, screens, and end plugs will have solvent-welded joints. Based on existing sieve analysis, both shallow and deep well casings will terminate in a manufactured, slotted pipe type, 0.015-in well screens. All screens will have an end plug to seal the open end and to act as a trap for sediment entering the well. Well casing and screen will be installed using centralizers. Wells will be filter-packed, grouted, and finished as per the hydraulic rotary method specifications contained in **Section 7.3.1 -- Ground Water Quality Monitor Wells.**

No surface casing will be required since the potentiometric surface monitoring wells are not scheduled to be constructed within areas of contamination. In addition, the potentiometric surface monitoring wells will not be sampled for any organic parameters, therefore, no decontamination of drilling equipment is required between installation of these wells. The drilling equipment will, however, be decontaminated prior to beginning installation of these wells.

7.1.3 Surface Casing

Surface casing will be utilized when drilling and installing monitoring wells through contaminated zones. Surface casing is intended to limit the spread of contaminants during well construction. When utilized, surface casing will be 8 in diameter, schedule 40 PVC, either threaded, flush joint or bell end secured with stainless steel screws. No solvent bonded connections will be allowed in wells utilized for water quality monitoring. The surface casing will be installed and fully grouted into a 12 in nominal diameter borehole and allowed to cure for a minimum of 12 hrs before proceeding with well installation.

For Surficial Zone water quality monitoring wells (depth less than approximately 65 feet) surface casing will be installed if soil headspace survey **(Section 7.4 -- Soil Headspace Survey)** taken between land surface and the water table shows organic vapor headspace concentrations greater than 10 ppm, or if significant contamination of the soils are known to exist. No clay layers or locally significant confining units appear to be present **(Work Plan Section 7.4 -- Existing Data)**, therefore, surface casing will be installed to a depth of 10 ft below the observed

water table. When surface casing is required, surface casing installation and subsequent Surficial Zone water quality monitoring well construction will be performed using the hydraulic rotary method.

For water quality monitoring wells completed in the Main Producing Zone (depths generally greater than 100 ft) the use of surface casing will be based on the results of water quality analysis of the Surficial Zone wells and the results of organic vapor headspace analysis performed during the construction of the Surficial Zone wells. Surficial Zone wells will be installed and sampled prior to installation of the Main Producing Zone wells (**Work Plan Section 11.0 -- Field Mobilization Plan**). If Surficial Zone analytical results show pesticides or volatile organic compounds to be present at levels greater than 10 times the detection limit, 8 in PVC surface casing will be installed approximately 20 ft into the Low Permeability Zone, or to a depth of approximately 80 ft below land surface.

7.1.4 Well Development

All newly constructed wells will be developed. Well development shall commence no sooner than 24 hrs after grouting of the well casing. Development of water quality monitoring wells will be accomplished by swabbing and pumping of the well, or, using compressed air with appropriate organic filter system to insure the compressed air is free of petroleum products. Development of potentiometric surface monitor wells and the production well will be accomplished using compressed air. Development will continue until clear, turbidity-free water is consistently produced and temperature, conductivity and pH fluctuations are less than 5 percent over a period of 10 min. Following development, the total depth below land surface of each well will be measured to within 0.1 ft using a weighted tape. The tape will be decontaminated as specified in **Section 6.3.13 -- In-field Cleaning of Water Level Measurement Devices.**

Development water shall not be moved off site. Development water will be allowed to infiltrate into the soil in the immediate vicinity of the well. The area of infiltration will be noted and recorded in the field notes. The senior field representative will determine if containment and analysis of the development water is warranted based on the guidelines provided by the U.S. Environmental Protection Agency, Office of Emergency and Remedial Response (OERR Directive 9345.3-02, Management of Investigation-Derived Wastes During Site Inspections, May 1991). The development water is not expected to pose an immediate threat to human health or the environment and is not expected to degrade the condition of the site. If containment, chemical analysis and disposal of the purge water is deemed necessary, a modification to the work plan will be required.

7.2 Drilling Equipment Decontamination and Cleaning

All drilling equipment will be decontaminated prior to entering Corry Station and prior to leaving Corry Station. All drilling equipment will also be decontaminated between installation of each well used for ground water quality monitoring. All downhole drilling equipment will be sandblasted prior to arrival on site at the beginning of each mobilization. Prior to the start of well construction, all drilling tools and equipment will be cleaned as specified below.

1. Clean power head, auger flights, bits, tremie pipe, drill table, drill pipe, mud pan, kelly, hand tools, etc. with pressure steam washer, brushes, and laboratory detergent (Liquinox or equivalent). No degreasing solvents shall be used to remove hydrocarbons from drilling equipment.

2. Rinse with potable tap water.

This protocol will also be used for cleaning sample collection equipment (split spoons, etc.) used to collect soils samples to be analyzed for physical parameters only. Decontamination wastes shall be disposed of as specified in **Work Plan Section 8.10 -- Decontamination Procedures**.

7.2.1 Cleaning Well Casings

Only casing and screen that is designed for subsurface environmental monitoring will be used. Factory pre-cleaned PVC casing and screen shall be transported to the field in their original plastic wrapping materials. In no case shall casings and screens be used that have any printing, ink, or stenciling on them. Casing and screen that has been contaminated with grease, hydraulic fluid, petroleum fuel, etc. shall not be used.

Immediately prior to lowering casing and screens into the borehole, plastic wrapping materials shall be removed. During all casing and screen handling and installation, new disposable latex gloves shall be worn. No cleaning of casings and/or screens shall be undertaken in the field.

7.3 Soil Headspace Survey

Selected soil samples and drill cuttings will be screened in the field for volatile organics compounds using an organic vapor analyzer (OVA) in the survey mode. Organic vapor analysis will be performed for all unsaturated soil samples. In addition, hollow stem auger drill cuttings, collected on 5 ft intervals between land surface and the water table, will be analyzed for organic vapors.

Representative samples will be placed in 2 16-oz jars, filling each half full, and promptly capped. Following collection, the jars are allowed to equilibrate for approximately 5 min at a temperature of approximately 70° F. At the end of the equilibration period the container lid is carefully removed or pierced to allow the insertion of the OVA probe. One sample will be measured with a carbon-tip filter attached to the OVA probe, and the other sample will be measured with no carbon-tip filter. Both readings obtained on the OVA in ppm will be recorded in the field notebook. The carbon filter will allow naturally occurring methane to be distinguished from other volatile organics. The OVA screening will be conducted in a sheltered area, affording protection from the potentially adverse affects of wind, precipitation, direct sunlight, and in an area where exhaust fumes are less likely to be present. Pertinent information such as weather conditions, (e.g., temperature, wind and humidity/rain) will be recorded during the screening process.

All OVA(s) that will be used for this process shall be calibrated at least one time each day of use. All calibration of the OVA will be completed in accordance with **Section 13.3.6 -- Organic Vapor Meters**. The carbon in the carbon filter shall be replaced at a minimum of once per day or once every hour, depending upon the frequency of OVA readings of 20 ppm or greater to ensure that breakthrough of the carbon does not occur.

7.4 Well Survey, Elevation, and Location

Following the installation of the monitoring wells, all existing and newly installed wells will be surveyed for elevation and horizontal location. All elevation and location surveys will be completed by a registered Florida Land Surveyor or a Professional Land Surveyor. Horizontal and vertical control benchmarks referenced will be recorded for each well surveyed.

All wells will be surveyed to determine the elevation of the top of casing (TOC), and a representative elevation of land surface immediately adjacent to the well's protective concrete pad, or adjacent to the well itself if no concrete pad is present. For existing supply wells where top of casing is not accessible, other suitable water level measurement point will be determined and surveyed. All elevations will be reported in feet and will be based on the National Geogetic Vertical Datum (NGVD) of 1929. Elevations will be surveyed to an accuracy of 0.01 ft. Each well's TOC will be permanently marked or identified on the well casing in order to reference water level measurements.

All wells will be surveyed to determine their horizontal location to an accuracy of 0.1 ft. Horizontal locations will be provided in Latitude/Longitude, UTM Zone 16 and State Plane coordinate systems. If accuracy of 2 to 5 m is acceptable to the EIC, Differential Correction Real-time Global Positioning System equipment and methods will be used.

7.5 Water Level Measurement

Routine water level measurements will be made to determine purge volumes, ground water gradients, flow directions, potentiometric surfaces, and to calibrate flow and transport models. All water level measurements shall be recorded to an accuracy of 0.01 ft and shall be measured from the designated, surveyed measure point (TOC for most wells, other surveyed measure point for selected supply wells). Date, time, held and wet measurements, measuring point utilized and the individual making the measurement will be recorded as applicable. A minimum of two consistent measurements will be made and recorded each time a water level measurement is required. All field data will be recorded in a hard-bound, water resistant field notebook.

Either electronic or steel measuring tape capable of 0.01 ft accuracy may be used. The tape will be decontaminated prior to use in any water quality monitoring well. Decontamination procedure of the water level measuring device will be completed in accordance with **Section 6.3.13 -- In-field Cleaning of Water Level Measurement Devices** and **Section 6.3.14 -- In-house Cleaning of Water Level Measurement Devices.**

Electronic data recorders will be installed on selected wells. Data recorders will utilize either float or pressure transducers and will provide water level accuracies within 0.01 ft and be referenced to the TOC measure point. Electronic recorders will generally be programmed to record water levels at intervals of 5 to 60 min, or as needed to meet project objectives.

8.0 SAMPLE CUSTODY, TRANSPORT, AND DOCUMENTATION

8.1 General Field Procedures

The minimum requirement for field documentation will be field notes, sample labels and sample transmittal forms. These items must contain enough information to allow a sample to be traced back to the original sampling event. Samples should be packed so that they are segregated first by site or sampling location, and second by sample analysis method, if the number of samples for a site exceeds ice chest capacity.

VOC samples from different locations may be placed into the same cooler to reduce the number of required trip blanks provided that the samples are wrapped or containerized (VOC vials inside ziplock bags inside metal paint cans) separately. Samples in breakable containers shall be packed with materials (i.e. bubble wrap, cans with vermiculite) to avoid breakage. Shipping transport containers shall be insulated (if cooling is required). Shipping containers shall be sealed with strapping tape or locked to avoid tampering. Tamper-proof seals may also be placed over cooler lid. All samples that require thermal preservation shall be packed in thermally insulated coolers with wet ice. Only wet ice shall be used in cooling samples to 4° C. Blue ice or chemical cooling packs are not acceptable.

Packed samples shall be delivered to the analyzing laboratory by the sampling team or via common carrier. If sent by common carrier, all documentation (transmittal form, bill of lading, analyses order, etc.) shall be sealed and placed inside the shipping container prior to sealing it closed. These records shall be placed in a plastic bag and taped to the underside of the cooler lid.

Sample custody requires that each event or procedure to which the sample is subjected be clearly and accurately documented. These include, but are not limited to; sample collection, field preservation, sample receipt and log in, sample preparation, sample analysis and sample disposal. Tasks or activities that relate to each of the above-mentioned events (e.g. reagent preparation, calibration, preventative maintenance, quality control measures, etc.) must be documented. The history of the sample must be clearly presented through the documentation. The required documentation that is associated with sample custody is outlined below.

Sample custody or tracking (as opposed to legal or evidentiary chain of custody) will be required during Phase II sampling activities. This will include all records and documentation necessary to trace a sample from point of origin through final report and sample disposal.

8.2 General Requirements for Custody and Documentation

8.2.1 Record Keeping System Design - General Requirements

Each organization with responsibility for sample custody shall maintain a record keeping system that allows a NWFWMD representative ready access and facilitates inspection and verification:

1. All records shall be maintained in a manner which facilitates documentation and sample tracking, allowing reconstruction of a chronological sequence of all analytical events and ancillary procedures that produced analytical results.

2. The system shall unequivocally cross-reference all documentation associated with a sampling event from sample collection through the final analytical result and sample disposal.

3. Records shall be immediately retrievable, including all working files and archived records.

4. Final reports, data summaries, or other condensed versions of data that have been prepared by external parties shall be linked to internal records by an unequivocal cross-referencing mechanism (usually sample and/or laboratory ID numbers).

8.2.2 Documentation Criteria

1. The history of a sample must be clearly evident from the retained records and documentation. Copies or originals of all documentation which are associated with the analysis or sample collection event must be kept. This includes the documentation that is sent to or received from all sampling and analysis organizations.

2. All applicable documentation specified in this section shall be available for inspection during any sampling-site, facility (laboratory or offices) or data audit conducted by the NWFWMD QA Officer or other NWFWMD representative. Audits may be conducted unannounced at any time during usual working hours.

3. The records must contain enough information so that explanations of the data are not required from the originator. Data must be clearly labeled.

4. All documentation and record entries shall clearly indicate the nature and intent of each entry.

a. All documentation entries shall be signed or initialed by responsible staff. The reason for the signature or initials shall be clearly indicated in the records (e.g. sampled by; prepared by; reviewed by, etc.).

b. Often, documentation requirements can be met by making brief references to procedures written in internal SOPs or approved methodology promulgated by external sources. If these standard procedures are routinely repeated in operations (e.g., sample preparation procedures, decontamination protocols, analytical method, etc.), then citing these references may be appropriate. The initial citation must specifically identify the document, method or SOP (e.g. sample preparation by 3010; field decon per internal SOP for Teflon sampling equipment, etc.), and must include any revision number or revision date. Copies of analytical references and all revisions must be retained as part of the laboratory documentation. Additional citations of a reference may refer to the initial citation by a common reference number.

8.2.3 Record-keeping Protocols

1. Entries into all records shall be made with waterproof ink.

2. Entries in records shall not be obliterated by erasures or markings. All corrections to record-keeping errors shall be made by one line marked through the error. The individual making the correction shall sign (or initial) and date the correction.

8.3 Preparation of Field Sampling Supplies and Equipment

All parties providing sample containers, preservation reagents or sampling equipment shall maintain tracking records.

A system of records or codes shall be designed to link cleaning records, preservation or reagent preparation records and trip blanks (if applicable) to the associated equipment, containers, prepreserved containers, analyte-free water and preservatives which may be shipped in sampling kits.

These records shall be maintained by the party responsible for providing any or all of the above-mentioned equipment, containers and/or reagents.

8.4 Custody and Documentation Requirements for Field Operations

The following documentation requirements shall be followed for all field-sampling operations.

8.4.1 General Protocols

1. Copies of all sample transmittal forms shall be maintained with project records.
2. Entries into all field records shall be made with waterproof ink.
3. Errors in all documents shall be deleted with one line and signed or initialed.
4. All documentation/logs shall be signed/initialed by the appropriate personnel.
5. All time shall be recorded using 24-hour, military notation in the current local time (Central Standard Time or Central Daylight Time).

8.4.2 Sample Identification Requirements

1. All sample containers must be labeled.
   a. At a minimum, the label shall identify the sample with the appropriate Sample ID number, site, date, time of sample collection, and sampler.
   b. Additional information (i.e. preservation, analysis, etc.) may be included as a part of the label.
   c. The label shall be securely attached to the sample container so that it is not accidentally removed during shipment and handling and so it does not contact any portion of the sample that is removed or poured from the container.

2. The Sample ID number shall be a unique number or code that is assigned to each sample container. The assigned code must unequivocally link the collected sample to the time and date of sampling, and shall include information concerning the location of the sampling point. The Sample ID will be based on the Well/Boring identification number (**Work Plan Section 9.0 -- Site-specific Assessments -- Phase II**) and an alphanumeric extension (e.x. CRY-6-18S-1, CRY-3-01B-B120). The alphanumeric extensions are discussed in **Work Plan Section 9.0**.

3. At a minimum, the Sample ID number shall be recorded on all sample labels, in the field records, and on all sample transmittal records.

4. Ancillary records (photographs, videotapes, maps, etc.) must be identified by specific sampling events and are subject to the same requirements as other records discussed in this section.

8.4.3 Required Documentation

All activities related to sampling events shall be documented in the field records. At a minimum, the types of records that must be maintained include, but are not limited to the following:

1. Sample labels (with identifying Sample ID numbers).
2. Sample transmittal forms.
3. Field sheets, logs, notebooks or other records.

8.4.4 Required Information

8.4.4.1 Sample Transmittal Records

All samples that are submitted to a laboratory must be accompanied by a sample transmittal record. This record may be designed as individual forms for each sample or a summary form for a set of samples. At a minimum, the information transmitted to the laboratory shall include:

a. Site name
b. Date and time of sample collection
c. Name of sampler(s) responsible for sample transmittal
d. Sample ID numbers
e. Number of samples collected at site and number in transported container.
f. Intended analyses -- the analytical methods and method numbers (if known) and shall be listed.
g. Preservation (may be indicated on sample label/field sheets)
h. Comments section (about sample or sample conditions)
i. Appropriate place for identification of common carrier (if used)

8.4.4.2 Field Records

The following information must be documented in the records maintained by the subcontractor performing sampling activities. All loose records (i.e. field sheets, photographs, etc.) shall be unequivocally linked to the sampling event by a suitable reference number.

a. General Information -- the following information shall be recorded for all sampling events:
   1. Names of all personnel and visitors on site during sampling
   2. Date and time of sample collection
   3. Field conditions, to include, but not limited to information such as weather, etc.

4. Well/Boring ID number according to the sample site numbering convention identified in **Work Plan Section 9.0 -- Site-Specific Assessments -- Phase II.**
5. Sample ID number for each sample container with note of parameters to be analyzed.
6. Field measurement data (e.g., pH, specific conductance, etc.)
   a. Records shall indicate when measurements were taken; and
   b. Time and date of last calibration.
7. Sample sequence - identify the order in which each sample is taken (time of sample collection.). The time that each sample aliquot is collected (i.e. VOC, metals, etc.) must be noted.
8. Preservative used - information must include, but is not limited to:
   a. Preservative name;
   b. pH verification (if applicable)
   c. Amount/quantity of preservative that is added (if adding preservatives in the field); and
   d. Amount/quantity of additional preservative that is added (if using sample containers with premeasured preservatives)
9. Purging and sampling equipment used (ID number of equipment, if applicable)
10. Field decontamination performed. All field-sampling equipment decontamination, whether performed in the field, on site or in a headquarters facility or laboratory, must be documented.
11. Types of QC samples collected. Include when and where collected, preservative (if applicable) and type (e.g., trip blank, equipment blank, duplicate, etc.). QC samples must be documented in the same manner as all other samples.
12. Use of fuel powered units (if applicable).
13. Composite samples (if collected) shall indicate number of samples in the composite, approximate amount/quantity of each subsample, vertical interval from which each subsample is taken.
14. Signature or initials of sampler(s).

b. Additional documentation for monitoring wells shall include:
   1. Water table depth.
   2. Calculations used to determine purge volume.
   3. Total amount of water purged.
   4. Date well was purged.
   5. Beginning and ending purge times.
   6. Measurements made to monitor stabilization.

c. Additional documentation for in-place plumbing and/or drinking water sources shall include:
   1. Description of sample collection point.

2. Flow rate at which well was purged (if known).
3. Length of time well was allowed to purge.
4. Purge time calculations.
5. Corry Station Public Water System ID number.

d. Additional documentation for sediments and soils shall include:
   1. Depth from the surface that samples were taken.
   2. Drilling/boring method, including type/name of drilling mud.
   3. Number of aliquots incorporated into composite samples.
   4. Equipment used to collect samples.

8.4.5 Sample Transport

1. All sample transmittal forms shall be placed in waterproof bags and sealed in the transport containers with the samples.
2. If shipped by common carrier, transport containers should be securely sealed with strapping tape or other means to prevent lids from accidentally opening.
3. All shipping bills from common carriers shall be kept with the transmittal forms.

8.5 Laboratory Custody, Documentation, and Transport

Laboratory responsibilities, beginning once the sample has been accepted from the sampling organization, shall be described in the laboratory Quality Assurance Project Plan.

9.0 MINIMUM QUALITY CONTROL REQUIREMENTS AND ROUTINES TO CALCULATE AND ASSESS PRECISION AND ACCURACY

9.1 QC Checks

9.1.1 Minimum Field Quality Control Requirements

9.1.1.1 Quality Control Checks

a. Field Quality Control Blanks
All blanks shall be preserved, transported, documented and handled as if they were samples. Once collected, they must remain with the sample set until they have been received by the laboratory. Field and equipment blanks shall be collected, treated, stored, transported and analyzed in the same manner as the associated samples. Equipment blanks are prepared by rinsing the sampling equipment with analyte-free water and collecting the rinsate in appropriate sample containers. For the purpose of determining the required number of Quality Control Checks, a mobilization, as defined in **Work Plan Section 11.0 -- Field Mobilization Plan**, will constitute a sample collection episode. The following types of blanks shall be collected as specified:

1. Field Blank: These blanks are prepared on site for all parameter groups. They are prepared by filling appropriate sample containers with analyte-free water, adding appropriate preservatives, sealing the containers, and completing the appropriate documentation. These blanks should be prepared during the middle to end of sampling event by filling sample containers with water from the equipment decontamination water containers.

2. Precleaned-Equipment Blank: These blanks are prepared on site for all parameter groups. These blanks shall be collected from sampling equipment that has been brought to the site precleaned and ready for use. These blanks shall be collected at the beginning of the sampling episode.

3. Field-Cleaned-Equipment Blank: These blanks are prepared on site for all parameter groups. These blanks shall be collected from sampling equipment after the equipment has been cleaned in the field (i.e., between sampling points).

4. Trip Blank: These blanks are required only if samples are to be analyzed for VOCs. They shall be prepared in accordance with **Section 6.5.2 -- Sample Containers, Preservation and Holding Times** by the organization that performs the final VOC vial preparation, and shall be prepared by filling

vials with analyte-free water. The vials shall be placed in the same transport containers as the empty VOC vials. They must remain with the VOC vials during the sampling episode and shall be transported to the analyzing laboratory in the same shipping or transport container(s) as the VOC samples. The trip blanks shall remain unopened for the entire sampling episode. A trip blank must be included in each cooler that transports empty or full VOC vials.

b. Field Duplicates

Field duplicates shall be collected, treated, transported, documented, and analyzed in the same manner as the associated samples. These samples are not laboratory duplicates. Duplicates are collected to measure the variability inherent in the sampling process. They shall be obtained by duplicating (simultaneously or in rapid succession) the entire sample acquisition technique that was used to obtain the first sample.

1. Duplicates for water are collected by sampling from successively collected volumes (i.e., samples from the next bailer of sample water).
2. Duplicates for soils are collected from the same soil sample source.

The frequency with which the above quality control samples are collected is summarized below:

# of Samples	Field Blank	Precleaned Equipment Blank	Field-cleaned Equipment Blank	Trip Blank (VOCs)	Duplicates
10+	minimum of one then 5%	minimum of one then 5%	minimum of one then 5%	one per cooler	minimum one then 5%
5-9	one	one*	one*	one per cooler	one
< 5	one	one*	one*	one per cooler	not required

For 9 or fewer samples collected during a mobilization, at least one precleaned-equipment blank or a field-cleaned-equipment blank is required. If equipment is cleaned in the field, the equipment blank must be a field-cleaned-equipment blank. If 10 to 20 samples are collected, at least one precleaned-equipment blank must be

taken and, if field cleaning is done, at least one field-cleaned-equipment blank. If greater than 20 samples are collected use the guidance below to determine the number of equipment blanks required. The more precleaned equipment brought to the field, the fewer equipment blanks are required.

Total Samples Taken	Total Pre-Clean Equip. Used	Required Field Cleanings	Precleaned Equip. Blanks	Field Cleaned Equip. Blanks
25	1	24	1	2
	5	20	1	1
	21	4	2	1
	25	0	2	0
30	1	29	1	2
	10	20	1	1
	21	9	2	1
	30	0	2	0
35	1	34	1	2
	15	20	1	1
	21	14	2	1
	35	0	2	0

9.1.1.2 Split Samples

a. The NWFWMD or SOUTHDIV may require split samples as a means of determining compliance or as an added measure of quality control. These type of samples are intended to measure the variability between laboratories and should be obtained as subsamples from the same parent sample.

b. A true split sample of soil, sediment or sludge is almost impossible to accomplish under field conditions.

c. Split samples shall be collected, preserved, transported and documented using the same protocols as the related samples. In addition, an attempt should be made to use the same preservatives (if required).

d. Split samples for water shall be collected in one of two ways:

1. Mix the sample in a large, appropriately precleaned, intermediate vessel and pour aliquots of the mixed sample into the appropriate sample containers. This method shall not be used if VOCs are of interest.

2. Fill the sample containers from consecutive sample volumes FROM THE SAME SAMPLING DEVICE (i.e., from the same bailer). If the sampling device does not hold enough sample to fill the sample containers, the following protocol shall be used:
   a. Fill the first container with half of the sample, and pour the remaining sample into the second container.
   b. Obtain additional sample, and pour the first half into the SECOND container. The remaining portion shall be poured into to first container.
   c. Continue with steps 1 and 2 until both containers are filled.

9.1.1.3 Quality Control on Field Measurements

a. All field instruments must be initially calibrated at the beginning of each working day.
b. A continuing calibration check shall be analyzed at intervals of no more than 4 hours and at the end of the sampling day to determine if the instrument has maintained calibration.
c. The instrument shall be recalibrated if the continuing calibration checks fail to meet acceptance criteria.
d. All quality control data shall be recorded in the daily field notes.
e. Subcontractors will analyze, in the field, and as requested by the NWFWMD QA Officer, field reference samples for specific conductance and pH.

9.1.2 Laboratory QC Checks

Laboratory QC Checks shall be addressed in the laboratory Quality Assurance Project Plan.

9.2 Routine Methods Used to Assess Precision and Accuracy

The following formula shall be used to assess precision and accuracy and the associated acceptance ranges.

a. Precision

The precision of duplicate pairs shall be calculated using one of the following formulas:

1. Percent Relative Standard Deviation (% RSD)

$$\% \text{ RSD} = \frac{s}{\bar{x}} \text{ X } 100$$

Where: $\bar{x}$ = Mean (average) of the data points

s = Standard Deviation calculated as:

$$\frac{\left[\sum_{i=1}^{n} (x - \bar{x})^2\right]^{1/2}}{(n-1)^{1/2}}$$

x = Individual value of the variable of interest

n = Number of points or data pairs to be included in the calculation

Substituting:

$\bar{x} = (A + B)/2$ and x = A or B, where A, B = concentrations in samples A, B

The equation for Percent Relative Standard Deviation becomes:

$$\% \text{ RSD} = \frac{|A - B| \text{ x } 2}{A+B \text{ x } \sqrt{2}} \text{ x } 100$$

2. Relative Percent Difference (RPD)

$$RPD = \frac{|A - B|}{A+B} \times 200$$

Where: A = concentration in sample A
B = concentration in sample B

3. Industrial Statistic (I)

$$I = \frac{|A - B|}{A+B}$$

Where: A = concentration in sample A
B = concentration in sample B

b. Accuracy

The accuracy of a measurement shall be determined by the recovery of a known amount of analyte in a real sample as:

$$\% R = \frac{Cs - Cu \ (100)}{S}$$

Where: Cs = concentration of spiked sample
Cu = concentration in unspiked sample
S = expected concentration of spike in sample
%R = percent recovery

The accuracy of a measurement based on known concentrations (i.e. performance evaluation samples) shall be calculated as:

$$\%R = \frac{\text{Sample Concentration } (100)}{\text{Reported True Value}}$$

d. Upper and Lower Warning and Control Limits

Upper and Lower Warning and Control Limits to be used as acceptance criteria shall be calculated as follows:

$$WL = P_{av} \pm 2\,S$$

Where: WL = Warning limit (upper and/or lower)
P_{av} = Mean of P (average percent recovery or average % RSD)

$$CL = P_{av} \pm 3\,S$$

Where: CL = Control limit (upper and/or lower)
S = Standard Deviation, calculated as:

$$\frac{\left[\sum_{i=1}^{n}(x - \overline{x})^2\right]^{1/2}}{(n-1)^{1/2}}$$

x = Sample Percent Recovery or precision of replicates, which is the variable of interest in this case
n = Number of points or data pairs to be included in the calculation
$\overline{X}$ = Mean (average) of the data points

10.0 DATA REDUCTION, VALIDATION AND REPORTING

Data reduction and validation is the responsibility of the subcontractor who generates the data. The following sections describe the steps taken to produce valid data of known integrity in both the field and the laboratory. Data reduction and validation activities appropriate to field-generated data will be implemented as presented here. Data reduction and validation activities appropriate to laboratory-generated data are presented to give subcontractors guidance regarding laboratory data validation. Substantative deviation from laboratory data reduction and validation outlined here shall be detailed in the laboratory Quality Assurance Project Plan, after approval of the procedure by the NWFWMD.

10.1 Data Reduction

Data reduction includes all activities that convert field instrument, lab instrument and computer responses into reportable results. These activities may involve mathematical calculations, substance identification and summary statistics. The final results may be obtained by direct readings from the instrument; or calculations based on instrument output, readings or responses.

The initial data reduction is the responsibility of the subcontractor who colectes the data. In addition, the subcontractor will be responsible for accurate identification and appropriate handling of routine samples and quality control samples (duplicates, blanks, spikes, etc.). These records will be kept at a location and in a format easily accessible to the NWFWMD (See also **Section 8.0 -- Sample Custody, Transport, and Documentation**).

A copy of the results of routine analysis and quality control analysis will be transmitted to the NWFWMD and/or its representative by the laboratory performing these analyses as both computer data files, following a format specified by the NWFWMD, and printed copies of the computer files.

10.1.1 Manual Data Reduction

Initial manual field data reduction is the responsibility of the analyst or field technician who operates the analytical instrument. That person shall:

a. Enter initial measurements and examples of all manual calculations into field records.
b. Enter the formulae and at least one complete sample of each type of calculation into the field record, with appropriate units at each step of calculation.

c. Record appropriate and accurate information concerning sample identification, operating conditions, etc.
d. Copy data into office records (notebooks, forms, spreadsheets, etc.) and verify that data are accurately transcribed.
e. Check raw data entries with final computer output to assure accurate data transfer and entry.

In addition, all initial raw data records and output (strip charts, tabular printouts, etc.) must be retained as a part of the permanent records. At a minimum the following information must be recorded and retained: Date of data collection, calculation, or transformation; Sample ID numbers; analyst or operator; type of analysis. In addition, the following information must be maintained: instrument operating conditions (if applicable); instrument or device types; etc. The latter information may be kept in cross referenced records or may be entered on the various output records.

10.1.2 Analytical Laboratory Computer/Integrator Data Reduction

Procedures to be used by the analytical laboratory to reduce instrument-generated data, printouts, etc. shall be described in the laboratory Quality Assurance Project Plan.

10.2 Data Validation

10.2.1 Data Integrity

Data integrity checking involves scrutiny of all field and laboratory data entries and calculations for errors and mistakes. It also involves reviewing all documentation to assure that initial Sample ID numbers track a route appropriate for the parameter, matrix and collection technique; that numbers have been accurately transmitted and manipulated, meters calibrated periodically, samples preserved and analyzed within appropriate holding times, Data integrity does not include assessment of quality control measures.

All data integrity checks should be performed by an individual (preferably a supervisor) who was not involved in the original data reduction process. The final responsibility for data integrity checks lies with the subcontractor performing the analysis. The following guidelines apply to both field and laboratory-generated data:

a. A minimum 10 percent of raw data entries for transcription accuracy;
b. A minimum 10 percent of all calculations randomly checked for mathematical errors including dilution factors, final volumes, dry weight factors and sample volumes or weights
c. Verify acceptability of calibration data;
d. Sample preparation logs and instrument or analytical logs to assure that samples were prepared and analyzed within prescribed holding times;
f. Cross check all records for completeness and for transcription errors associated with the sample number;
g. Verify all sample transmittal records (if applicable) for completeness and acceptability.
h. Check for consistency between the dates, sample locations, parameter codes, sample numbers, etc shown by field sample collection and sample transmittal records and those reported by the laboratory.

10.2.2 Data Validation

Data validation is accomplished through an ongoing series of checks and reviews that are intended to assure that the reported results are of an acceptable and demonstrable quality.

These tasks should be performed by the subcontractor who performed the analysis, preferably by an employee who was not actively involved with generating the data:

1. Verify that the results of all quality control blanks analyses meet criteria;

2. Review all other quality control data (spikes, duplicates, quality control check standards, quality control check samples, etc.) for acceptable accuracy and precision;
3. Identify any sample set or data that are unacceptable and initiate appropriate corrective actions;
4. Check the proper assignment the data qualifier codes to reported values according to the usage defined in **Section 10.0 -- FDEP SOPs** (if needed);

The outcome of this data validation shall be reported to the NWFWMD as soon as the results are known. If corrective action is required the NWFWMD will be consulted before the corrective action is initiated, except for actions necessary to correct a temporary and isolated problem that will not bias measurement or findings, the NWFWMD will be informed of the effect of a corrective action as soon the effect is evident.

10.3 Data Reporting and Overall Project Results Validation

10.3.1 Data Reports

All final data reports from subcontractors responsible for data collection, reporting and validation shall be forwarded to the NWFWMD as computer records and in hardcopies. The format for reporting field and analytical data in digital form is presented below.

Well / Boring Number	Site Date	Time	Replicate	Code	Parameter Symbol	Value	Parameter Limit	Detection Confidence	Agency	Collecting Agency	Analyzing Remarks	
A15	A1	D	A4	A2	N	A1	N	N	A1	A4	A4	A4

A: alphanumeric - combination of characters and numbers with specified width.

N: numeric - numbers with or without decimal digits.

D: date - mm/dd/yy.

Well name - A maximum of 15 alphanumeric characters identifying the site of sample collection (well or boring). Must be unique to location; and must not be changed at any time.

Format:	15 alphanumeric characters.
Typical Values:	CRY-01-14D.
Legal Values:	Any unique alphanumerical identifier up to 15 characters long.
Missing Values:	Field must be filled.
Notes:	This must uniquely identify well throughout the reporting agency and cannot be changed.

Site type - G for ground water, soils and sediments.

Format:	1 alphanumeric character
Typical Values:	G
Legal Values:	Any unique alphanumerical identifier up to one character long.
Missing Values:	Field must be filled.

Date - Month, day and year sampling was completed (slash (/) delimited).

Format:	8 alphanumeric characters in MM/DD/YY form where: YY is year MM is month DD is day
Typical Values:	01/01/1993
Legal Values:	Any real date.
Missing Values:	Field must be filled.
Notes:	Duplicate samples will be addressed by sample sequence number. No modifications to the sample date will be used to differentiate between duplicate samples.

Time - Hour and minute sampling was completed.

Format:	4 numeric characters in HHMM form where: HH is hour in military 24 hour format MM is minute
Typical Values:	0930, 1356, 2330
Legal Values:	Any real time
Missing Values:	0000
Notes:	Note that time is in 24 hour format where 2PM is 1400.

Replicate - Sequence number to differentiate between independent samples taken at the same well at the same time (split or duplicate samples).

Format:	2 numeric characters
Typical Values:	01,02
Legal Values:	01 to 99
Missing Values:	01
Notes:	A sequence number is used to uniquely identify analytical results coming from two otherwise identical samples. These samplings must have occurred at the same exact time -- if this is not so, then the sample time field will be used to identify to which sample particular analytical results refer.

Parameter code - USEPA STORET data base code for the analyzed parameter.

Format:	5 numeric characters
Typical Values:	00010, 76356, 01305
Legal Values:	Any valid USEPA STORET code
Missing Values:	Field must be filled
Notes:	Leading zeros should be included -- 00299 NOT 299. STORET codes refer to specific measurement units -- make sure analyticalvalues reflect the correct measurement units. Parameters which do not have official STORET codes will be assigned temporarypseudo-STORET codes.

Symbol - Below detection limit flag; a marker for an analysis whose result is below the analytical detection limit.

Format:	1 character
Typical Values:	<
Legal Values:	<
Missing Values:	blank
Notes:	Parameter value field holds the detection limit when Symbol field has a < character. 0.0 is not valid for Parameter value field when Symbol field has a < character.

Parameter value - Results of analytical determination of the parameter sampled.

Format:	11 numeric characters with or without decimal digits
Typical Values:	100.34, -150.0, 0.0030
Legal Values:	Any valid value
Missing Values:	Field must be filled
Notes:	A value of 0.00, 0.0, 0, etc. is used only for parameters whose absence can be assured.

Detection limit - Estimated lowest concentration determinable for this parameter.

Format:	12 numerical characters with or without decimal digits
Typical Values:	1., 0.50, 15.0
Legal Values:	Any valid value

Missing Values: Field must be filled
Notes: Detection limit field has same units as Parameter value field.

Confidence - Value qualifier; comment on "goodness" of this data (5 denotes highest confidence; 1 denotes least).

Format: 1 numeric character
Typical Values: 1, 2, 3, 4, 5
Legal Values: 1, 2, 3, 4, 5
Missing Values: blank
Notes: Reason(s) for assigning value other than 5 should be described in the remarks field.

Collecting agency - A four digit numerical code identifying the agency which actually collected the sample.

Format: 4 digit numerical - no decimal point, no decimal digits
Typical Values: 8034,8240,8025
Legal Values: Variable, can be assigned for any agency without a code
Missing Values: Field must be filled
Notes: This is agency which actually performed the sample collection.

Analyzing agency - A four digit numerical code identifying the laboratory which actually performed the analysis.

Format: 4 digit numerical - no decimal point, no decimal digits
Typical Values: 8034, 8240, 8025
Legal Values: Variable, can be assigned for any agency without a code
Missing Values: Field must be filled
Notes: This is agency which actually performed the analysis.

Remarks - Any necessary comments about the analysis.

Format: 4 alphanumeric characters
Typical Values: Any alphanumeric comment up to 4 characters describing the quality of the sample
Legal Values: Any valid comment
Missing Values: blank

10.3.2 Project Results Validation

Subcontractors shall be responsible for validation of all data submitted to the NWFWMD, according to the following procedures:

10.3.2.1 Laboratory

a. Review all identified quality control checks.
b. Assure that any deviations or questionable data have been reported with qualifiers or with appropriate explanations.
c. Check for overall project consistency and any obvious anomalous values.
d. Check for clerical errors, transposed numbers and accurate data transfer.

10.3.2.2 Field

a. Review all quality control data for project acceptability.
b. Attach appropriate justification or explanation for any questionable data.
c. Check for overall project consistency, including comparison with historical or expected results.
d. Check for clerical errors, transposed numbers and accurate data reporting.

All final reports should be verified and signed by the project manager(s), laboratory director or other individual who is responsible for the overall operations of the organization.

10.4 Data Storage

Records generated by the NWFWMD, or that come into the possession of the NWFWMD, as a result of this project shall be retained according to the policies and procedures of the NWFWMD.

11.0 PERFORMANCE AND SYSTEMS AUDITS

11.1 Field Audit Requirements

11.1.1 Internal Audits

Internal systems audits shall be conducted by the subcontractor QA Officer or his or her designee a minimum of once during the course of Phase II. Internal systems audits shall be conducted by the subcontractor more frequently in response to unacceptable or questionable QC or sample data. The internal systems audit is a review and evaluation of the various components of the measurement and sample collection procedures.

An internal systems audit shall review in detail each component of the sampling system, from collection to delivery for analysis. For example, such activities as decontamination, meter and sampler calibration, field measurements, matrix sampling, Quality Control measures, documentation, sample custody, etc. should be examined. A determination shall be made that each element of an activity is functioning appropriately and within the guidelines of the proper methodology, the approved procedures and QA Plan. A list of deficiencies that must be addressed to correct, improve and modify the system must be generated as an end result.

Internal performance audits on field activities are not required as a part of Phase II. If utilized, they should be documented as to the supplier of the sample, the type of sample used, and results should be included in all internal or external QA reports.

11.1.2 External Audits

External systems audits shall be conducted by the NWFWMD QA Officer during the course of Phase II. The frequency shall be determined by the NWFWMD QA Officer (minimum of once during Phase II). External performance audits shall be conducted by the NWFWMD QA Officer during the course of Phase II and will include submission of blind reference samples to the subcontractor performing specific conductivity and pH measurements in the field. Results of external performance audits shall be documented and results shall be included in all internal or external QA reports.

11.2 Laboratory Audits Requirements

11.2.1 External Audits

The NWFWMD does not anticipate conducting any external audits of the laboratory selected to provide analytical services during the course of Phase II.

11.2.2 Internal Audits

Procedures associated with internal systems audits and internal performance audits as conducted by the analytical laboratory shall be described in the laboratory Quality Assurance Project Plan.

Internal systems audits should be conducted as the complement to implementation and use of internal SOPs and Quality Assurance Plans, in order to assure good Quality Assurance management practices.

In general, procedures for conducting internal audits should be developed according to the following guidelines:

a. Schedule systems audits to occur with routine frequency. Annual auditing of all lab operations is a minimum recommendation. Audits of selected systems may be staggered throughout the year to accomplish this goal.

b. Develop a standardized protocol and list of minimum requirements which will constitute the style and scope of the audit and which will provide the criteria list by which operational deficiencies can be detected. These protocols and criteria should reflect the intent of all internal SOPs and Assurance Quality Plans, and should at a minimum conform to all FDEP SOP requirements for procedures and documentation. The use of standardized audit forms and checklists is recommended.

c. Designate appropriate personnel as Quality Assurance staff and charge these officials with auditing responsibility and authority, preferably independently of and lateral to the chain of authority responsible for laboratory operations.

d. Encourage all staff members to adopt good Quality Assurance practices, at all levels of the organization and to perceive audits as an educational opportunity.

12.0 QUALITY ASSURANCE REPORTS

Quality assurance reports are designed to keep the NWFWMD and SOUTHDIV informed of the performance of QA/QC activities. Required QA reports shall include all subjects which address the validity and documentation of data gathering activities. They shall summarize any project-specific audits, list significant problems, and discuss the solutions and corrective actions implemented concerning QA/QC activities.

12.1 Submission of QA Reports to NWFWMD

Quality assurance reports shall be submitted to the NWFWMD for each calendar quarter of the project duration. These reports shall be prepared and submitted according to the following guidance and shall be prepared by all subcontractors having direct responsibility for field or laboratory analytical activities. Quarters for which no audits were performed and for which no significant QA/QC problems occurred shall have a letter submitted asserting the following:

1. No Project Audits were performed;
2. All sampling and support equipment were used as listed in the approved **QAPP**;
3. All preservation and holding time requirements have been met;
4. All field QC Blanks and duplicate results are within acceptable ranges; and
5. All analytical requirements for precision, accuracy, and MDL/PQL have been met.

12.2 Requirements for a Full Report

A more lengthy project report shall be required if any of the following occurred during the quarter of interest:

1. Sampling and support equipment other than that specified in the approved **QAPP** were used;
2. Preservation or holding time requirements for any sample were not met;
3. Any quality control checks (field and laboratory) were unacceptable;
4. Any analytical requirements for precision, accuracy, or MDL/PQL were not met;
5. Sample collection protocols or analytical methods specified in the **QAPP** were not met;
6. Corrective action on any problem were initiated;
7. An internal or external systems or performance audit was conducted; or
8. Any other activity or event affected the quality of the data.

12.3 Full Report Contents

The more detailed QA reports, when required, shall contain the information listed below:

1. Title Page - The following information shall be listed:
   a. Time period of the report
   b. Consultant/Laboratory Name, address and phone number
   c. Preparer's name and signature

2. Audits - summarize all project specific audits that were performed during the specified time period:
   a. Performance audits must include the following:
      1. Date of the audit
      2. System tested
      3. Who administered the audit
      4. Parameters analyzed
      5. Reported results
      6. True values of the samples (if applicable)
      7. If any deficiencies or failures occurred, summarize the problem area and the corrective action.
   b. Systems audits must include the following:
      1. Date of the audit
      2. System tested
      3. Who administered the audit (agency or company)
      4. Parameters analyzed
      5. Results of tests
      6. Parameters for which results were unacceptable (include the reported and true values, if applicable)
      7. Explanation of the unacceptable results. Include probable reasons and the corrective action.
   c. Copies of documentation such as memos, reports, etc. shall be enclosed.

3. Significant QA/QC Problems
   a. Identify the problem, and the date it was found.
   b. Identify the individual who reported the problem.
   c. Identify the source of the problem.
   d. Discuss the solution and corrective actions taken to eliminate the problem.

4. Corrective Actions Status
   a. Discuss the effectiveness of all corrective actions taken during the specified time frame as well any initiated during the previous report period.

b. Discuss any additional measures that may be implemented as the result of any corrective action.

12.4 QA Reporting Frequency

Quality Assurance Reports/Letters shall be submitted by subcontractors to the NWFWMD QA Officer on a quarterly basis. This documentation will be forwarded to SOUTHDIV upon review by the NWFWMD QA Officer. As necessary, NWFWMD will suppliment the Quality Assurance Reports/Letters with additional information deemed necessary to keep the EIC informed.

12.5 Internal QA Reports

At a minimum, information will be circulated as necessary to keep project members informed of the performance of QA/QC activities. This may be provided in the appropriate form of communication (verbal, formal memorandums or reports) to insure sound QA/QC management practices. Copies of memorandums and reports shall be filed with the project information as well as written logs of verbal communications.

13.0 CALIBRATION PROCEDURES AND FREQUENCY

13.1 Introduction

This section stipulates minimum calibration requirements necessary to ensure that the field parameter measurement system is capable of producing acceptable data. Acceptable calibration protocol must involve a demonstration that the instrument or measuring system is capable of acceptable performance at the beginning of the analysis sequence and that initial calibration is still valid after continued system operation.

Procedures used for calibration of laboratory instrumentation shall be described in the laboratory Quality Assurance Project Plan.

13.2 General Considerations

Calibrations must be performed according to all analytical method directives, manufacturer's recommendations or as indicated in this **QAPP**, if specifics are not addressed in the cited method or manufacturer's recommendations.

Analytical method calibration acceptance criteria must be followed or, if acceptance criteria are not specified in the method, general criteria presented in this **QAPP** shall be used to verify an acceptable calibration.

The number of calibration standards used to achieve an acceptable calibration must adhere to the cited method.

13.3 Minimum Calibration Requirements for Field Instruments

This section describes pre-inspection calibration, field calibration, office/lab calibration, and use of field instruments. Instrument-specific or model-specific calibration and operation procedures are not included. If the following procedures do not apply to particular equipment, the pertinent analytical reference and the manufacturer's operating/owner's manual shall be used in lieu of recommendations provided here.

13.3.1 General Considerations

Calibration of field instruments shall be performed on a regular basis with records kept on field sheets, field logs or in a separate calibration log. The records must indicate the method used to calibrate, the time and date, number of standard(s), resulting meter response, actions taken, and the results of the calibration. Optionally, the meter name, model number, and identification number (if applicable) may be entered.

Maintenance and repair notes shall be made in a maintenance logbook or field notebook. If rental equipment is used, a log is not required. However, the origin (i.e. rental company), rental date, equipment type, model number and identification number (if applicable) shall be entered into the field notes or a rental equipment notebook.

Prior to mobilization, the field analyst shall verify that all equipment is in proper working condition, calibrated, and that batteries are properly charged.

Field calibration of each meter shall occur daily, at the first sample site and must be verified throughout the day. This will ensure field data of a known quality. All field calibrations and checks shall be noted in the field notebook or on field sheets.

13.3.1.1 Minimum Quality Control Requirements

a. Once the meter has been calibrated, continuing calibrations checks shall take place at intervals of no more than 4 hrs and at the end of the sampling day. For instance, the pH meter will be checked against the pH 7 buffer, thermistors will be checked against field-grade thermometers, conductance meters will be checked against one KCl standard, etc.

b. If a field meter fails a continuing calibration, a complete initial calibration must be performed.

Documentation on calibration standards (e.g., buffers, KCl, and other reagents) shall be maintained.

a. At a minimum, the date of receipt, expiration dates (noted on the bottle label), and date of first use shall be noted on the standard container.
b. Expiration dates must be followed.
c. If reagents or standards are prepared from stock chemicals, they must be analytical reagent grade or better. NOTE: Potassium chloride standards must be of primary standard grade.

13.3.2 pH Meters

13.3.2.1 General Concerns

a. The pH meter is field calibrated on a daily basis at the first site. Since field meters do bump around from site to site, calibration is likely to change. Calibration checks must be made per **Section 13.3.1.1 -- Minimum Quality Control Requirements**.
b. Calibration may be checked on a weekly basis in the office or laboratory to ensure the percent theoretical slope is not less than 90 percent, indicating a bad electrode. This should be noted in the calibration records. If percent slope cannot be determined on a meter, or the manufacturer's optimum specifications are different, the manufacturer's recommendation for maintaining optimum meter performance shall be followed.
c. There are several interferences to keep in mind with pH measurement:
    1. coatings of oils, greases, and particulates may impair the electrode's response. The electrode bulb should be regularly rinsed with deionized water and shaken dry. If not, acetone may be used to clean very hard-to-remove films, but must be used sparingly so the electrode surface is not damaged;
    2. temperature effects on the electometric measurement of pH are controlled by using instruments having temperature compensation or by calibrating the meter at the temperature of the samples;
    3. poorly buffered solutions with low specific conductance (<200 μmhos/cm) may cause fluctuations in the pH readings. Equilibrate electrode by immersing in several aliquots of sample before taking pH.
d. Follow the instructions with each type of pH meter. Use secondary standard buffer solutions (pH of 4, 7, 10) purchased from commercial vendors for calibration. Do not reuse buffers.
e. Each meter/electrode system must be calibrated at a minimum of two points, at least three pH units apart, bracketing the expected sample pH. Ground waters from the Sand-and-Gravel Aquifer will generally be less than 7.0 pH units.
f. Under normal conditions a pH measurement should be accurate to +/- 0.1 pH unit. Remember the needle of the pH meter must align with its image on the mirror on the gauge to get an accurate reading. Similar care must be taken when recording digital read-out.

13.3.2.2 Calibration and Field Use

a. Check the battery before mobilizing and turn the meter on when the first facility is reached to allow the meter to equilibrate to ambient temperature.
b. Calibrate the meters prior to taking samples:
    1. Estimate the sample pH range (Ground waters from the Sand-and-Gravel Aquifer will generally be less than 7.0 pH units)
    2. Turn function switch to pH position

3. Select the appropriate buffers to bracket the expected sample pH, either pH 4 buffer and pH 7 or pH 7 and pH 10.
4. Remove the protective cap, rinse the electrode with deionized water (DI) and shake dry.
5. Place and swirl the electrode in the pH 7 buffer and turn the calibration knob until the readout is 7.0. Rinse the electrode with deionized water (DI) and shake dry.
6. Place and swirl the electrode in the second buffer solution (pH 4 or 10). Adjust the temperature knob until the reading is that of the pH standard. Rinse the electrode with deionized water (DI) and shake dry.
7. Measure the temperature of the second buffer solution.
8. Turn the slope indicator until the arrow of the temperature compensator points to the temperature of the buffer. The percent to the theoretical slope should be read from the slope scale. A slope of less than 90 percent (or one not meeting the manufacturer's specifications) indicates a faulty electrode or contaminated buffer and the problem should be corrected before proceeding.

c. After calibration follow these procedures to take a pH reading of a freshly collected sample:
   1. Place the pH probe in the flow-through cell and measure the sample temperature. If it differs more than 2° C from the buffer temperature, adjust for the difference by turning the slope indicator until the arrow to the temperature compensator points to the sample's temperature.
   2. Read the field pH value.
   3. Turn the meter off after the last reading, rinse the electrode thoroughly with deionized water and replace the electrode's rubber cap.

d. In lieu of performing internal QC checks on field instrument performance, additional calibration checks will be mandatory. Continuing calibration shall be performed per the following:
   1. After the initial calibration, the pH meter shall be checked against the pH 7 buffer at intervals of no more than 4 hours.
   2. The meter will also be checked against the 7 buffer after sampling has been completed.
   3. If the sampling event takes less than 4 hours, then an initial calibration and a post-calibration check will be adequate.
   4. If, during the continuing calibration, the response is greater than 0.2 pH units on either side of 7, then a complete initial calibration must be conducted.
   5. All initial and continuing calibrations shall be completely documented in bound notebook or field sheets, including: date/time, standard(s) used, resultant meter response, action taken, and technician initials.

13.3.3 Temperature

13.3.3.1 General Concerns

a. Temperature determinations can be made with any field-grade mercury-filled, alcohol-filled, or dial-type Celsius thermometer as well as an electronic thermistor. The dial-type thermometer is preferred over the glass type for field work because of its durability and ease of reading.

b. All thermometric devices shall, at a minimum, be checked annually in the laboratory against a National Institute of Standards and Technology (NIST) precision thermometer.
   1. The temperature measuring device should be checked at two temperatures against the NIST precision thermometer.
   2. Temperatures should agree within +/- 0.1° C. Make note of the calibration in the calibration records. Note the make, model, and serial number of each thermometer.
      a. Thermometers that do not meet the acceptance criteria should be disposed of properly.
      b. If the difference is shown to be constant (i.e. + 0.5° C) over the thermometer range, the thermometer may be used provided that the difference is documented for 10 degree increments, and the correcting factor is used in all measurements.
      c. Use care and proper cleaning procedures to prevent sample cross-contamination.

13.3.3.2 Calibration and Field Use

a. All field-grade thermometers must have completed the annual check against the NIST-grade thermometer. All thermistors must be calibrated in the field with a field-grade (or NIST-grade) thermometer.

b. Allow the thermometer or thermistor (always use one which has been properly calibrated) to equilibrate to ambient temperature.

c. Insert thermometer or thermistor in situ when possible or in a portion of the sample. Swirl and take readings when the mercury column, needle, or read-out becomes constant; record the temperature to the nearest 0.5° C. Read to the nearest 0.1° C for a digital gage.

d. Continuing calibration must also be performed for thermistors. The thermistor should be checked against the field-grade thermometer at 4 hour intervals and at the end of the sampling day.

13.3.4 Dissolved Oxygen Meter

13.3.4.1 General Concerns

a. Before sampling the DO meter should be calibrated in water-saturated air to make sure it is operating correctly. The DO meter should be calibrated on samples free of interference, in the laboratory, and against the Aside modification of the Winkler Method of determining dissolved oxygen on an annual basis.

b. Turbulence is necessary to keep a constant flow of water across the membrane-sample interface. Be sure the stirrer is working before using the probe.

c. Store the probe with a cover that creates a saturated atmosphere. A cap, with a wet sponge in it, will suffice.

d. Before mobilizing, check to make sure there are no bubbles beneath the probe membrane and no wrinkles or tears in the probe membrane. If so, replace the membrane and KCl. Check the leads, contacts, etc. for corrosion and/or shorts if meter pointer remains off-scale, does not calibrate, or drifts.

e. Dissolved inorganic salts are an interference with the performance of DO probes. For example, the taking of DO readings in salt water is affected by the salinity and must be corrected by adjusting the salinity knob. Adjust the meter based on readings taken from the specific conductivity/salinity meter or use appropriate calculations to correct for salinity.

f. Reactive gases which pass through the membrane may interfere. For example, chlorine will depolarize the cathode and cause a high probe output. Long-term exposures to chlorine will coat the anode with the chloride of the anode metal and eventually desensitize the probe. Sulfide (from H_2S) will undergo oxidation if high enough potential (voltage) is applied, creating current flow, yielding faulty readings. If such interferences are suspected, the membrane electrode should be changed frequently, and must be calibrated at more frequent intervals.

g. DO probes are temperature sensitive, and a method of temperature compensation is normally provided by the manufacturer.

13.3.4.2 Calibration and Field Use

a. Annual Laboratory Calibration
   1. Fill a clean bucket with uncontaminated or deionized water and place the probe into the bucket. Siphon water from the bucket into two Biological Oxygen Demand (BOD) bottles. Make sure to place siphon hose on the

bottom of the bottles and overflow the bottles by three volumes. Determine the DO by the Winkler method (see Standard Methods for the Examination of Water and Wastewater for more details).

2. Adjust the DO meter according to manufacturer's instructions. Be sure to adjust the meter to the temperature of water in the bucket, then calibrate the DO indicator dial to read the average DO concentration of the two samples determined by the Winkler test.
3. Keep a calibration log.
4. If the air calibration seems to operate properly but the oxygen concentrations disagree with the results of the Winkler calibration by more than 0.2 mg/L it is time to have the electrode or meter serviced or replaced.

b. Prior to mobilizing and at each sample site, air calibrate the DO meter in water saturated atmosphere to make sure the meter is reading correctly.
   1. Turn meter on for at least 10 minutes before the initial field calibration and use. Shake any droplets off the membrane surface. For YSI meters, and most others, the meter must remain on redline to keep the membrane polarized. Do not turn off until the end of the day.
   2. Once the probe/calibration chamber are stable at ambient temperature, check the air temperature and determine, from the DO versus temperature table (usually on the meter's battery pack), what the DO should measure. (It is difficult to get a stable ambient temperature if the probe is sitting in the sun).
   3. With the probe as close to the water surface as possible (saturated atmosphere) turn the knob to read DO. Adjust the calibration knob until the DO reading is at the theoretical level determined in b.2. above.

c. Using the salinity measurement (if appropriate) from the conductivity meter, adjust the salinity control knob on the DO meter (ignore if your meter automatically adjusts for salinity). Take the DO reading and record it on the field sheet.

d. Place the DO probe in the flow-through cell and record field value.

e. Keep the probe in the saturated atmosphere between sites and events. If the readings show distinct, unexplainable changes in DO levels, or when the probe has been in waters with high sulfides, recalibrate using the Winkler method.

f. While taking a reading, if it is very low, e.g., below 1.0 ppm, allow it to stabilize, record it and then, remove and rinse the probe, as the environment is very likely anoxic and may contain hydrogen sulfide, which can damage the probe.

g. Continuing calibration must also be performed on the DO meter. The meter should be air calibrated at 4 hour intervals and at the end of the sampling day.

13.3.5 Specific Conductivity Meter

Specific conductance is a useful method to approximate the total amount of inorganic dissolved solids. Conventional conductivity devices consist of two or more platinum electrodes separated by a test solution. The major disadvantage with this type of system is the possibility of polarization or poisoning (fouling) of the electrodes. Conductivity systems based on the measurement of inductance or capacitance are also available. The electrodes in these systems are insulated by a layer of glass or other insulating material. System response is less rapid, but problems with fouling and polarization are eliminated. Conductivity varies with temperature. For example, the conductivity of saltwater increases 3 percent/degree C at O° C, and only 2 percent/degree C increase at 25° C. Therefore, it is necessary to record temperature with conductivity measurements or to adjust the temperature of the samples prior to making conductivity measurements. Most conductivity meters have temperature compensation.

13.3.5.1 General Concerns

a. Follow the manufacturer's instructions.
b. Samples are preferably analyzed at 25° C. If not, temperature corrections are made and results reported at 25° C.
c. With good equipment an accuracy of +/- 1 percent of the reading is achievable.
d. Typically a conductivity meter is combined with a thermistor to measure water temperature. The temperature measurements are used for both conductivity and DO corrections.

13.3.5.2 Calibration and Field Use

a. The meter should be checked in a laboratory in one of three ways:
   1. Follow method specifications;
   2. Use two standard potassium chloride solutions of 100 and 1,000 µmhos/cm or standards that bracket the range of expected sample conductance; or
   3. A single check standard in each range of a multi-range instrument.

b. If the meter does not read within 1 percent of the standards, determine what the problem is and correct it before proceeding. Most field instruments read conductivity directly. If the meter does not correct all values to 25° C, calculate corrective factors using the procedure in **Section 13.3.5.3 -- Calculations** below. Record all readings and calculations in the calibration records.

c. The meter must be calibrated in the field with at least one KCl standard prior to analyzing the first sample. The chosen standard must be close to the conductance value of the real samples.

d. Use during a sampling event:
   1. Turn the meter knob to redline before use. Follow the manufacturer's recommendations or redline approximately 15 - 20 minutes before use.
   2. When at a site or facility adjust the redline knob to align the needle directly over the redline, using the mirror reflection, if available.
   3. Place the conductivity probe in the flow-through chamber. Measure the water temperature with the conductivity probe.
   4. If the meter is equipped with automatic temperature compensation, adjust the temperature knob on the conductivity meter to the water temperature and read the conductivity. The conductivity meter has a set of positions which multiply the reading by powers of ten in order to measure the full range of potential conductivities. Set this dial to the correct range in order to take a reading. The reading, with the temperature gauge adjusted properly, reports conductivity measured at 25° C.
   5. Switch the dial to take a salinity reading. Use this reading to adjust the DO meter for salinity, if necessary. This should not be used for reporting salinity as a measured parameter, since the calibration is not directly applicable. It may be used as an estimate for salinity for compensation of a DO measurement.
   6. If using at more than one site or sampling location, keep the probe polarized by turning the meter's knob to redline and keeping the probe in water between locations.
   7. Continuing calibration must be performed on the conductance meter. The meter should be checked against the one KCl calibration standard at 4 hour intervals and at the end of the sampling day.
   8. Rinse off the probe with deionized water and turn off when finished for the day. Store the probe in deionized water at all times, if it dries out it takes 12 - 24 hours to rejuvenate it.

13.3.5.3 Calculations

a. If the meter does not automatically correct for temperature, or if a probe with a cell constant other than 1 is used, the following formula shall be used to correct the data to 25° C:

$K = [(Km)(C)]/[1 + 0.0191(T-25)]$
Where: K = conductivity in µmhos/cm at 25° C
Km = measured conductivity in µmhos/cm at T degrees C
C = cell constant
T = measured temperature of the sample in degrees C
If the cell constant is 1, the formula for determining conductivity becomes:
$K = (Km)/[1 + 0.0191(T-25)]$

b. Refer to SM 2510B, 17th edition, if other calculations (i.e. determining cell constant, etc.) are required.

13.3.6 Organic Vapor Meters

Organic vapor meters may be used to perform qualitative or screening procedures in many different situations. These devices are equipped with either a flame ionization (FID) or a photoionization (PID) detector. The FID ionizes organic molecules via a hydrogen flame, whereas the PID uses a lamp. Lamps with different electron voltage (eV) may be used with the PID to ionize specific groups or classes of organic compounds. For specific lamp applications consult the owners manual. These meters may be used for ambient air screening at sites for health and/or safety reasons. They can be used for headspace analyses of soil samples to determine "gross contamination", for well placement, or for grid sampling. Calibration and use of these types of meters should be performed after consulting the owners manual. There are several procedures that must be accomplished at a minimum:

1. Calibration must be performed on-site, prior to sampling, it is also suggested that additional calibrations against one span gas be performed at 4 hour intervals and/or at the end of the sampling day.

2. The meter must be zeroed with "zero air" or equivalent. If known to be free from interfering components, ambient air may be used.

3. At least one span gas must be used for calibration.

4. Carbon filters must be used to distinguish between methane and other aliphatic halocarbons (FIDs only).

5. Background corrections must be made if soil borings or split spoon samples are analyzed in ambient air (unnecessary for headspace samples performed in mason jars under foil).

13.4 Laboratory Instruments

Calibration procedures and frequency for laboratory instruments will be described in the laboratory Quality Assurance Project Plan. If samples are sent to another laboratory due to equipment failure the subject laboratory must have an FDEP-approved CompQAP for the parameters of concern and the Project Manager must be notified.

14.0 PREVENTIVE MAINTENANCE

Responsibility for preventive maintenance lies with field personnel and supervisory personnel in charge of the monitoring equipment. The analytical staff should consistently watch for signs of the erratic performance of field meters. Technical support by vendor specialists and in-house experts capable of corrective actions beyond simple repairs or maintenance is important to the uninterrupted functioning of this equipment.

The Preventive Maintenance Program shall consist of the following:

1. Adherence to the Preventative Maintenance schedule found in Table 14-1;

2. Documentation of all maintenance and repairs (records should be easily accessible);

3. Vendor operation and maintenance manuals should be up-to-date and quickly available to field personnel for all instrumentation; and

4. Backup equipment must be maintained and ready for immediate use, so that sampling schedules can be met.

Table 14-1 identifies preventive maintenance activities for field instrumentation by instrument type with recommended frequencies. It may be necessary to perform activities more frequently depending on heavy workloads, sample types analyzed and/or instrument performance. If the instrument manufacturer recommends more frequent or additional maintenance activities these shall also be incorporated into the facility maintenance program.

Laboratory preventative maintenance activities will be described in the laboratory Quality Assurance Project Plan.

TABLE 14-1

PREVENTIVE MAINTENANCE SCHEDULE

INSTRUMENT/ACTIVITY	FREQUENCY
pH PROBE	
Check probe for cracks and proper levels of filling solution; check reference junction; clean electrode	daily[1]
check response time	daily
pH METER	
Check batteries and electronics for loose connections and cracked leads	daily[1]
CONDUCTIVITY METER	
Check batteries and probe cables	daily[2]
Replatinize Probe	
DISSOLVED OXYGEN METERS PROBE	
Check membrane for deterioration; check filling solution	daily[1]
DISSOLVED OXYGEN METER	
Battery level and electronics checked	daily
THERMOMETERS	
Check for cracks and gaps in the mercury	daily[1]
TEMPERATURE PROBE	
Check connections, cables	daily
Check against calibrated thermometer	daily
FLAME IONIZATION DETECTOR	
Clean	quarterly
Replace flame tip	annually

KEY:

1 Replace as necessary

2 Replace upon QC failure

Daily is defined as prior to use or a 12-hour period if equipment is run continuously.

15.0 CORRECTIVE ACTIONS

Quality controls will be used to monitor and assess the effectiveness and validity of sampling and analytical activities. If a specified quality control measure is determined to be out of a predetermined acceptance range, and the source or reason for the deviation is not identified and corrected, the related data may not be useful or even valid. Some quality control criteria (e.g. calibration) audit the accuracy and precision of measurements. Others (e.g. blanks and duplicates) are indicators of improper protocols or contamination.

The quality controls, acceptance criteria and corrective actions identified here refer primarily to field procedures. Controls, criteria, and actions appropriate to laboratory activities shall be detailed in the laboratory Quality Assurance Plan.

15.1 Quality Control Measures and Acceptance Criteria

Table 15-1 identifies each of the quality control checks that are required by test methods and/or acceptance criteria.

15.2 Identifying and Assessing QC Measures

Responsibility for the initial assessment of a quality control measure lies with the individual who identifies the sample or procedure as a QC measure; has access to the test results. Initial corrective action is performed by this individual or referred to his supervisor. Ultimate authority for implementation of corrective action resides with the NWFWMD QA Officer. The NWFWMD QAO is notified by quarterly report of quality control failures and the corrective actions taken during the previous quarter.

TABLE 15-1

ACCEPTANCE CRITERIA FOR FIELD QUALITY CONTROL CHECKS

QC CHECK	ACCEPTANCE CRITERIA
BLANKS	
Field blank	<MDL for all parameters
Precleaned equipment blank	<MDL for all parameters
Field-cleaned equipment blank	<MDL for all parameters
Trip blank	<MDL for all parameters
FIELD CALIBRATION	
pH	+/- 0.1 standard pH units
Specific conductance	+/- 1 percent of standards
Temperature	+/- 0.1° C
FIELD QC CHECKS	
pH	<+/- 2 standard deviations from most probable value
Specific conductance	<+/- 2 standard deviations from most probable value

The personnel operating field meters or their supervisors are responsible for the initial and continuing calibration of these instruments. The NWFWMD QAO, or his designee is responsible for checking the need for corrective action or the success of corrective actions. The NWFWMD QAO may assess the results of QC tests using standard reference material, QC check samples, spiked samples (matrix and blank), duplicates, precleaned-equipment blanks, field-cleaned-equipment blanks, trip blanks, field-collected duplicates, or split samples. The responsibility for assessment of these checks may be delegated to a representative of the NWFWMD, the subcontractor or his representative, or laboratory personnel. In any case, the results of these assessment will be reported to the NWFWMD QAO.

Finding the source of a QC problem involves identifying probable sources of error, and checking each source to determine if the protocols were properly followed. Usually, the individual who is responsible for identifying the problem is responsible for determining the cause.

15.3 Initiating Corrective Action

When the source of a QC error has been identified, appropriate steps must be taken to eliminate or minimize recurrences. If a QC criteria are not met, testing cannot continue until the QC check meets specifications. Corrective actions may be initiated:

1. By the individual who is operating a field instrument; or
2. By an individual in oversight authority (i.e. subcontractor or NWFWMD QA Officer) if a solution is not immediately apparent.

15.4 Documentation and Notification of Affected Parties

If a quality control measures fails to meet acceptance criteria, the QC measure, and the procedures were used to correct the problem must be documented.

1. Corrective actions that are initiated during an on-going sampling event may be documented in the meter log and/or field logs.

2. Corrective actions that require input or intervention of more than one individual must, at a minimum, be documented in the related logs and records.

3. If more than one organization is involved with identifying a QC problem and the associated corrective actions, sufficient written documentation shall be prepared to fully detail the extent of the QC problem and the steps taken to correct it. In this case, a copy of all documentation shall be maintained in the project files.

If an identified quality control problem affects more than one set of data or multiple projects, the documentation associated with identifying and resolving the problem must be cross referenced to all associated projects. In all cases, the NWFWMD QA Officer should be promptly informed of all QC problems and the steps taken to remedy those problems.

TABLE 15-2

CORRECTIVE ACTIONS FOR QUALITY CONTROL CHECKS

1. BLANKS

a. Sources and expected review procedures:
   1. Contaminated reagents - verify reagent sources
   2. Environmental Contamination (all sample collection, sample and analysis conditions) - review sampling handling protocols
   3. Improper or incomplete in-house and/or field decontamination/cleaning procedures - review cleaning protocols
   4. Contaminated sample containers - verify source and storage conditions
   5. Contaminated source water - verify water sources

b. Expected Corrective Actions:
   1. Review data with respect to reported contamination levels. If sample concentrations are near the reported blanks levels, reprocess (reextract or digest) associated samples or resample. If sample concentrations or the reporting levels are significantly higher than blanks, or contaminants are not detected in the samples, report the sample data and concentrations in blank.
   2. Take measures to eliminate future problems: discard reagents, revise protocols, perform preventative maintenance on system, adjust use of interfering chemicals (solvents, fuels, etc.).

2. CALIBRATION

a. Sources and expected review procedures:
   1. Improperly prepared or outdated standards - review preparation logs for calculation/dilution errors and use of expired sources.
   2. Improperly prepared or outdated check standard - verify check standard
   3. Poor instrument response - determine if preventative maintenance is required
   4. Incorrect calculations - review and verify all calculations
   5. Contamination problems (see blanks above)

b. Expected Corrective actions:
   1. Obtain fresh standards
   2. Recalibrate instrument
   3. Perform preventative maintenance
   4. Take measures to eliminate sources of contamination
   5. Repair instrument

15.5 Corrective Actions From External Sources

The need to initiate corrective action may be the result of activities or audits from external sources. Sources include systems audits; performance audits; split samples; blind QC samples; and findings from project or data validation review.

16.0 DEFINITIONS

Analytical Set: The basic unit for analytical quality control. Also known as sample set or analytical batch. The analytical set is defined as samples which are analyzed (or sampled together) with the same method sequence, the same lots of reagents and with the same treatment common to all samples. The samples must have been analyzed (or collected) within the same specified time period or in continuous sequential time periods. Samples in each set should be of similar composition.

Audits: A systematic check to determine the quality of the operation of some function or activity.

Performance Audits: Quantitative data are independently obtained for comparison with routinely obtained data in a measurement system. Examples of these audits are EPA performance evaluation programs, commercial performance evaluation programs, split sampling program involving at least two laboratories, blind spike samples.

Systems Audits: These are qualitative in nature and consist of an on-site review and evaluation of a laboratory or field operations quality assurance system and physical facilities for sampling, calibration and measurements.

Project Audits: These consist of an independent review of all sampling and analytical activity records that are associated with a specific project or event to determine if the resulting data are valid and acceptable. Enough documentation must be available so that a reviewer is able to reconstruct the history of the samples from time of sample collection (or sample container acquisition) through final results and sample disposal.

Calibration: Process by which the correlation between instrument response and actual value of a measured parameter is determined.

Confidence Level: The statistical probability associated with an interval of precision (or accuracy) values in a QC chart. The values of confidence intervals are generally expressed as percent probability. It is a commonly accepted convention that the result being tested is significant if the calculated probability is greater than 90 percent, and is highly significant if the probability is greater than 99 percent.

Data Quality: The totality of features and characteristics of data that bears on its ability to satisfy a given purpose. The characteristics of major importance are accuracy, precision, completeness, representativeness, and comparability. These characteristics are defined as follows:

Accuracy: The degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference or true value, T, usually expressed as the difference between the two values, X-T, or the difference as a percentage of the reference or true value, 100 (X-T)/T, and sometimes expressed as a ratio, X/T. Accuracy is a measure of the bias in a system. Accuracy shall be calculated according to the formulae in Section 9.2 of this Manual.

Precision: A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions." Precision shall be calculated according to the formulae listed in Section 9.2 of this Manual.

Representativeness: Expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Comparability: Expresses the confidence with which one data set can be compared to another.

Data Quality Objectives: A set of specifications that the environmental data must meet in order to be acceptable for its intended use in a program area. DQOs are commonly established for limits of detection and quality of data (precision, accuracy, representativeness and comparability).

Detection Limits: The smallest concentration/amount of an analyte of interest that can be measured with a stated probability of significance. Detection limits must be further defined as:

Method Detection Limit: The smallest concentration of an analyte of interest that can be measured and reported with 99 percent confidence that the concentration is greater than zero. The MDLs are determined from the analysis of a sample in a given matrix containing the analyte at a specified level.

Practical Quantitation Limit: The smallest concentration of an analyte of interest that can be reported with a specific degree of confidence. PQLs shall be determined in the same way as MDLs.

Detection Limit: The smallest amount of an analyte of interest that generates an instrument response (signal) under prescribed conditions such

that the magnitude of the signal is larger than the absolute uncertainty (error) associated with it.

Environmental Sample: Means any sample from a natural source or source that may reasonably be expected to contribute pollution to or receive pollution from ground waters or surface waters of the state. This includes, but is not limited to: receiving waters; waters used to define natural background conditions; soils; sediments; industrial, domestic or municipal discharge effluents; chemical storage or handling facilities; waste disposal facilities or areas; industrial or agricultural chemical handling or application areas; surface water run-off; and facilities for handling or applying of chemicals for weed or insect control. Parent Sample: Refers to a sample from which aliquots are taken for testing purposes. Subsample: Refers to any derivative obtained from a sample. These include, but are not limited to: aliquots; filtrates; digestates; eluates; fractions; extracts; reaction products; supernatants; etc.

Organizational Terms:

Internal: Refers to operations, personnel, documents and protocols within the specified organization.

External: Refers to operations, personnel, documents and protocols from a party that is separate from or outside the specified organization.

Parameter Group: Is defined as a group of samples that have been preserved in the same manner, prepared by similar protocols and analyzed using instruments of similar technology (also known as analyte group). Examples of parameter groups are:

Volatiles (EPA methods 601, 602, and 624)
Pesticides (EPA methods 608, 614, 622)
Trace Metals (All metals except mercury)
Nutrients (Total Kjeldahl Nitrogen, Nitrate + Nitrite, Total Phosphorous)

Performance Evaluation Samples: A sample submitted for analysis whose composition and concentration are known to the submitter but unknown to the analyst. Also known as a Blind Sample.

Quality Assurance: A system of activities whose purpose is to provide the producer or user of environmental data the assurance that it meets defined standards of quality with a stated level of confidence.

Quality Assurance Plans (QAP): An orderly assembly of detailed and specific procedures which delineates how data of a known and accepted quality is produced.

Comprehensive Quality Assurance Plan (CompQAP): A QA plan that outlines all the capabilities of the specified organization, the routinely used quality control measures, the routine QA targets for precision and accuracy, and all documentation, calibration and maintenance activities that are necessary to produce data of a known and acceptable quality.

Quality Assurance Project Plan (QAPP): A QA plan that is written for a specific project outlining specific QA targets and data quality objectives as well as all protocols and QC measures needed to meet the project specific objectives.

Quality Control: The overall system of activities whose purpose is to document and control the quality of environmental data so that it meets the needs of the users.

Quality Control Measures:

1) Blanks: An artificial sample of an analytical matrix designed to monitor the introduction of artifacts into the system.

   a) Field Quality Control Blanks

      1) Field Blanks: Blanks of analyte-free water that are prepared on-site by filling appropriate sample containers with the water, adding appropriate preservatives, sealing the containers, and completing the appropriate documentation. These blanks should be prepared during the middle to end of a sampling event by filling sample containers with water from the equipment decontamination water transport containers. They are to be treated, stored, transported, and analyzed in the same manner as the sample group for which it was intended. These blanks may be submitted for all water parameter groups.

      2) Equipment Blank: Blanks of analyte-free water that are prepared on-site by pouring the equipment decontamination water through decontaminated field equipment. Appropriate sample containers, for each analyte group must be used, preservatives added, if required, and appropriate documentation must be completed. These blanks are to be stored, transported and analyzed with the intended parameter groups. At least one equipment blank is required for each water and solid matrix analytical group, and must be collected at the beginning of the sampling episode. If field decontamination is performed on-site, additional equipment blanks must be submitted for all water and solid matrix analytical groups.

3) Trip Blank: These blanks are required for only VOC samples. Blanks of volatile organic free water that are prepared by the organization that is providing the sample containers (for this project, the organization that performs the final preparation of the VOC vials prepares the trip blanks). These are transported to the site with the empty VOC sample containers, and shipped to the analyzing laboratory in the same containers as the VOC samples. They remain unopened for the entire trip. Proper labeling and documentation must be completed. A trip blank must be submitted for each cooler that transports VOC samples.

b) Laboratory

1) Method Blank: A blank of an appropriate analyte-free matrix that is processed (digested, extracted, etc.) and analyzed with a specified sample set.

2) Reagent Blank: An aliquot of analyte-free water or solvent that is analyzed with a sample set.

2) Spiked Samples: Samples fortified to a known and validated concentration of analyte. Percent recoveries are calculated for each compound in the spike.

a) Field: An environmental sample fortified to a known and validated concentration in the field. These may be submitted as blind spike (laboratory does not know they are spiked) or as identified field spikes.

b) Laboratory:

1) Reagent Spikes: Samples of an appropriate analyte-free matrix (deionized water, sand, soil, etc.) that are fortified to a known and validated concentration of analyte(s) before sample preparation.

2) Sample (Matrix) Spikes: Environmental sample selected from a set (not blanks) that are fortified to a known and validated concentration of analyte(s) before sample preparation. The concentration of each analyte in the spiking solution should be approximately 3-5 times the level expected in the sample.

3) Surrogate Spikes: Samples fortified with a compound having similar chemical characteristics to the compounds of interest, but which is not normally found in environmental samples. Known concentrations of these compounds are added to all samples in the set before sample preparation.

3) Replicate Sample: Samples that have been collected at the same time from the same source (field replicates) or aliquots of the same sample that are prepared

and analyzed at the same time (laboratory replicates). Duplicate samples are one type of replicate sample. The analytical results from replicates are used to determine the precision of a system. If the concentration of analytes in the sample are below detectable limits, Duplicate Spike Samples may be used to determine precision. Blind Replicates (Duplicates) are replicates that have been collected (field replicate) or prepared (laboratory replicate) and are submitted and analyzed as separate samples (analyst does not know they are replicates).

4) Quality Control Checks: Standards or samples from an independent source that are analyzed at a specified frequency.

   a) Quality Control Check Standards: Standard solutions from a source other than normal calibration standards that are certified and traceable. These standards are used to check the accuracy of a calibration curve.

   b) Quality Control Check Samples (also known as Reference Materials): Samples obtained from an independent source for which the level(s) of analytes have been validated. These samples are prepared and analyzed with a sample set of similar matrix. If these samples have been obtained from the National Institute of Standards and Technology (formerly National Bureau of Standards), these are referred to as Standard Reference Materials.

5) Split Samples: Replicates of the same sample that are given to two independent laboratories for analysis.

6) Acceptance Criteria: The numerical limits, prescribed by the approved analytical method or internal data, by which an analytical system is verified. These numerical limits may be generated from internal, historical data. Also known as Control Limits.

Sample Custody - All records and documentation required to trace a sample from point of origin through disposal after analysis. These records must include, but are not limited to:

1) Field notebooks;
2) Field sample ID tags;
3) Laboratory transmittal forms (if applicable);
4) Laboratory sample receipt logs;
5) Sample extraction/preparation logs or worksheets;
6) Analytical (instrument) logs or worksheets;
7) Calibration and quality control data associated with a sample set;
8) Instrument maintenance logs;
9) Sample disposition logs; and
10) Final reports.

Legal Chain of Custody is a special type of sample custody in which all events (i.e. possession, transport, storage, and disposal) and time intervals that are associated with a specific sample must be documented in writing. In addition to the records described above, chain of custody records must include the following:

1) Sample transmittal forms or tags that have adequate spaces for the dated, original signatures of all individuals who handle the sample (or cleaned sample containers if obtained from a contracted laboratory) from time of collection (or container receipt) through laboratory delivery.

2) Laboratory sample storage logs that identify date, time, and individuals who remove samples from storage.

3) Secure, limited access storage areas.

Sample Matrix means that characteristic of an environmental or laboratory sample, associated with its physical and chemical properties, which defines how such a sample is handled when subjected to the intended analytical process. The following samples matrices (major matrix groups), as defined below, should be used in QA plans whenever specifying data quality objectives:

Analyte-Free Water: Water in which all analytes of interest and all positive or negative interferences are below method detection limits. The absence of such components shall be documented by analytical records.

Reagent Water: A sample of water which conforms to ASTM grades II, III or IV.

Drinking Water: Includes finished (treated) or raw source water designated as potable water. Such sources may be from surface or ground water.

Surface Water: Includes fresh or saline waters from streams, canals, rivers, lakes, ponds, bays and estuaries (natural or manmade).

Groundwater: Includes all waters found below ground in confined or unconfined aquifers.

Sampling Kit: A set of sampling accessories that has been assembled for a specified use or project. A Sampling Kit may include, but is not limited to: sample containers; sampling equipment (e.g., bailers); sample preservatives, trip blanks;reagent transfer tool (e.g., disposable pipets); calibration standards; indicator papers (e.g., pH paper); or reagents.

17.0 REFERENCES

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